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The New Chief of Engineers

IN the light of the present movement to bring into closer relationship and mutual interchange of knowledge the engineers of the two Americas, it seems a happy coincidence that a moving up in rank in the U. S. Army Engineer Corps, due to the retirement on account of age of Brig.-Gen. D. C. Kingman, should bring to its head such a man as Brig.-Gen. William M. Black, whose appointment as chief of engineers is noted in the news section of this issue. General Black knows the Latin-American peoples, and proved by his actions in Cuba that he appreciates the worth of their engineers. In addition he has had broad experience in dealing with problems vital to many of the Latin-American countries. In any gathering of engineers during his term of office such as occurred during the recent Pan-American Scientific Congress in Washington, the International Engineering Congress at the Panama-Pacific Exposition in San Francisco, or minor conventions in which the engineers of the two Americas come into contact, it cannot but have a good effect upon the engineers of the countries to the south to encounter as the official head of our military engineers a man so familiar with their problems, so well versed in their ways and so appreciative of their worth.

Would Highway Engineers Respond?

AN ARMY officer of high rank told a gathering of engineers recently that the War Department lacks information on the strength of highway bridges and on the grades, surfacing and conditions of roads throughout the country. Although an army could hardly move to repel invasion or execute maneuvers without such knowledge, repeated efforts have failed to have it added to the excellent maps of the United States Geological Survey. The obstacle has been, so it is stated, the impossibility of securing an appropriation for the work. There is a way, the Engineering Record believes, of getting part of the desired information promptly and at the nominal expense of postage and the time of draftsmen required to transfer it to existing maps. Judging from the courtesy of engineers in official positions to the Engineering Record in forwarding information requested by letters—and for less vital reasons—state and county engineers everywhere would respond promptly to a request from the War Department for all the data in their possession. After all of the information which can be secured in this way is in hand, missing and evidently inaccurate data can be secured and corrected by field survey. In many sections of the country, probably, the data are not in hand and such survey work will be needed before any but the most meager information can be secured. Eventually the whole country will need to be covered by field work, for obviously the data gathered by highway engineers are not always as complete as needed for army purposes. At present, however, quick action is needed. Probably most of the information in reference to the North Atlantic and the Pacific coast roads is in fairly good shape and could be quickly assembled. In the Southern and the Gulf states the data may not be so readily available. Taking the country as a whole, however, much data can be quickly collected. The cost would be trifling.

Short Courses vs. Conventions

THIS journal has in the past argued for a single national highway convention each year, supplemented by state and district conventions, giving special attention to the local conditions. The rapid spread during recent years of short courses in highway work leads one to believe that this desideratum, at least so far as district meetings are concerned, has possibility of accomplishment. Within the last two months there have been not less than ten of these short courses, in as many universities. Registrations have run as high as 500. Such short courses, when the theoretical lectures given by the instructional force are reinforced by talks from practical men, serve every function of the state or district convention. Moreover, men go to the short courses with a more serious purpose, the idea of a junket being entirely absent. Instead, therefore, of encouraging state and district conventions, fashioned along old-style lines, highway officials should throw their influence in favor of the short courses, endeavoring to get their subordinates who have any authority and responsibility in the construction and maintenance of roads to attend. Provided the instructors will see that the practical features and details are given adequate attention and that sufficient time is allowed for questions and discussion, the further development of the short-course movement is destined to have a great influence for good upon highway building and maintenance.

Forestall Typhoid Epidemics

TYPHOID epidemics are prevalent at this season of the year in localities using untreated surface water supplies. Rains and melting snow wash foul matter into streams. This condition leads the New York State Department of Health to say, in its monthly *Almanac*, that "water-borne epidemics of typhoid fever in towns with unprotected water supplies may be safely set down as an *Almanac* prediction for March, 1916." In the light of recent advances in the art of water sterilization, however, there is not, to-day, the same ground for alarm which existed a decade ago. Although sterilization cannot generally be considered as a substitute for filtration, but rather as a supplement, much good will result from the installation of chlorinating apparatus in towns not provided with a filter plant. The State Department of Health estimates that about 6,750,000 people in New York State are now receiving a public supply of pure water; 900,000 receive water from questionable, and 250,000 from distinctly dangerous public sources, while about 2,000,000 people depend on private sources of supply. For the 1,150,000 people in municipalities with dangerous or doubtful public water supplies this is a good time of year to consider whether it is not poor economy to run the risk involved in drinking unpurified water from unprotected ponds and streams. All such waters may be rendered safe for drinking by simple and inexpensive processes of filtration or disinfection. The installation of a plant for disinfecting water by means of liquid chlorine, the Health Department points out, will insure the protection of most supplies at an altogether negligible cost—between one and two cents per person per year.

City Planning in Philadelphia

TWO WEEKS AGO, in commenting on the pioneer work of the Newark City Plan Commission, the Engineering Record mentioned the pioneer city-planning work of another sort being done in Philadelphia in the undeveloped South Philadelphia tract. Newark's problem is one of conception; Philadelphia's is one of execution. How the Philadelphia Bureau of Surveys, through its General Plans Division, is doing the work—providing deeper building lots, making street widths fit the needs, introducing open places and other irregularities to break up the monotony that characterizes the older streets of most American cities—is set forth at length on page 344. An attempt has been made to go deeper into the reasons for certain details than this journal has ever done before, and the Engineering Record hopes the article will be valuable to all city planners. As pointed out in the beginning of the article, the large South Philadelphia tract affords an exceptional field for the city planner in that it is now almost wholly undeveloped, is adjacent to the developed sections and can be rather definitely assigned to certain uses. Aside from that, the planners are most fortunate in that the authority of the Board of Surveyors is broad, and the board is able to put its plans through without interference from other municipal authorities. This was not always so, however, and the General Plans Division was obliged to do much missionary work before it could get a favorable attitude toward its efforts. The whole subject is one that is rapidly coming to the front, and the Engineering Record welcomes this double opportunity of commending the excellent work of Philadelphia's engineers, and setting forth ideas that may be of service to others who have not advanced so far in the new combination of science and art.

The Road Builders' Convention

LAST week the American Road Builders' Association held a convention and a manufacturers' exhibition in Pittsburgh. This was the meeting scheduled, so this journal holds, in violation of the spirit of the agreement under which the Pan-American Road Congress was held in Oakland, Cal., last September. The prejudice against the convention on account of this violation, and the efforts made to dissuade manufacturers from exhibiting, had a very noticeable effect. The attendance was only fair and composed very largely of local people—from Pennsylvania and West Virginia. State highway officials were noticeable by their absence. The machinery and materials show was only a shadow of its former self. It was a distinct disappointment to those ignorant of the efforts made to quash the exhibit entirely, and who consequently had set their standards by the great exhibit in Chicago in December, 1914.

Contrasted with the Second National Conference on Concrete Road Building, held two weeks previously in Chicago, the Pittsburgh meeting made a poor showing, both in attendance and in caliber of men. Compared with other road meetings, however, the showing was favorable, at least in the number of interested attendants at the sessions. This is true whether the meeting be contrasted with previous conventions of the same association or with the American Road Congresses, held under the auspices of the American Highway Association. In fact, it is difficult to recall any sessions of the road congresses where discussion has been so keen as in the sessions on concrete and on brick roads at Pittsburgh.

One naturally inquires whether the Pittsburgh meeting gave any indication as to what might be expected in reference to the possibility of holding only one national highway convention in the future. Some expected that the showing would be so poor as to force the American Road Builders' Association into seeking for some arrangement with the American Highway Association by which simultaneous sessions would be insured. The result did not bear out the expectation. While, broadly, last week's convention was a second-rate affair, it indicated that the association has enough virility to force recognition and to be a real factor in the future of highway promotion. It will not be lightly pushed aside. Whereas the American Highway Association is a continuing organization that not only holds a convention annually but, by its highway publicity work and the publication of the Good Roads Year Book, renders a service throughout the year, the Road Builders' Association exists solely for the purpose of holding a convention and a show. Nevertheless, it has demonstrated its ability to hold a meeting under adverse circumstances, even though it failed badly on the machinery and materials exhibit.

The conclusion that must be reached, therefore, is that the American Road Builders' Association is still a factor to be reckoned with in the highway field. If, in the face of all of the opposition it met in connection with the Pittsburgh convention, it was able to do anything at all—which it did—it should receive recognition, even though it renders a smaller service to the highway field than its younger and more energetic rival.

Shall We Save New York?

THE title of this note was used as the heading for a full-page advertisement run in the New York City newspapers this week, introducing a remarkable campaign to safeguard a certain section of the city against factory invasion. Some years ago, after the completion of the Interborough subway, the wholesale clothing dealers and manufacturers began to desert the section along Broadway from City Hall to Thirteenth Street and spread northward as far as about Twenty-third Street. This section built up very rapidly with loft buildings devoted exclusively to the housing of these interests, but such was the movement that long since Twenty-third Street ceased to be the northern limit of the new district. Now clothing factories can be found as far north as Thirty-seventh Street. Even Fifth Avenue, the city's finest retail business street (reference is made to the section south of Fifty-ninth Street), has been invaded.

The result is that loft buildings without any character architecturally, covered in every window and at every floor level with flaring gold-letter signs proclaiming the names of the wares and their makers, are destroying the character of a district heretofore devoted exclusively to residences, handsome hotels and clubs, theaters, restaurants and high-class retail establishments. Obviously the district would lose its characteristics were the increase in the number of factories to continue at the present rate.

The high-class retail mercantile establishments, therefore, have banded together and have decided to use the dollar argument in their campaign. One can prophesy that it will prove effective. Twelve prominent companies—including such establishments as B. Altman & Company, Lord & Taylor and James McCreery & Company—have announced in full-page advertisements that they will give preference in their purchases of cloaks, suits, furs, clothing, etc., to firms whose manufacturing plants are located outside of a zone bounded by Thirty-third and Fifty-ninth Streets, Third and Seventh Avenues. They promise, further, that they will not show this preference until Feb. 1, 1917, thus enabling manufacturers now located in this zone to secure other quarters. They promise, too, that consideration will be given those firms that remove their plants. It is stated that as soon as the seriousness of the situation was put to the clothing manufacturers they assented to the plan and agreed to help.

In this campaign the retail merchants are receiving the hearty support of hotels, clubs, banks and other mercantile establishments in the specified zone. Without a doubt the city of New York will benefit by the segregation—or rather the exclusion campaign. It is significant, though, that accomplishment of the desired end is not allowed to wait upon securing suitable legislation. In fact, it may be questioned whether the legislation would be legal, since the factories in themselves are not a nuisance.

While those unfamiliar with the situation will feel that the action taken is rather drastic, it needs only an examination on the ground to convince one that quick and forceful steps are needed. Much that attracts visitors to the city is concentrated in the exclusion zone. If allowed to deteriorate the impression made by the city on visitors will be decidedly unfavorable. One can wish, therefore, that the efforts of the manufacturers will prove successful.

Qualifications for Engineering Work

IN accordance with the announcement made some time ago, the Carnegie Foundation for the Advancement of Teaching has sent a second letter to the members of engineering societies asking them to indicate the qualifications which make for success in professional work. Unlike the first letter, however, which made no suggestions as to the needed qualifications, the second circular in giving a summary of the results of the first inquiry presents certain qualities for consideration.

The readers of the Engineering Record know, from the account given in the report of the annual meeting of the American Society of Civil Engineers, in the issue of Jan. 22, and the editorial on the subject the following week, what the first returns were. The essential factors, summarized from the first letter, fall naturally into six groups, and these are named here in the order of their importance, as determined by the frequency of their occurrence in the replies:

1. *Character*, integrity, responsibility, resourcefulness, initiative.
2. *Judgment*, common sense, scientific attitude, perspective.
3. *Efficiency*, thoroughness, accuracy, industry.
4. *Understanding of men*, executive ability.
5. *Knowledge* of the fundamentals of engineering science.
6. *Technique* of practice and of business.

With this tabulation before them the members of the society are now asked to indicate their views as to the relative importance of these qualifications.

Naturally, what is desired is a single arrangement of these six groups which will most nearly indicate the views of the country's engineers. Manifestly, however, the individual in picking a new employee or in determining upon promotion will arrange these groups in accordance with the requirements of the position in mind. For a given position, requiring a certain type of mentality, some one group will stand out as much more important than the others, while that group may be far down the scale when another position is in question.

If, for example, a designer is to be selected, the rearrangement of the groups (using the catch word only) might be as follows: Knowledge, judgment, technique, character, efficiency, understanding of men. In other words, such a man, devoting himself entirely to the drafting room, where his characteristics and peculiarities do not affect those outside the organization, with little work of an executive character, might do very well even with low grading on the understanding-of-men group.

On the other hand, if candidates are hired for construction work, the understanding-of-men group might be placed first in importance, with the other groups in the following order: Judgment, character, technique, efficiency, knowledge.

Again, should the position be one in which the young man will quickly find it necessary to do executive work and to bear considerable responsibility in the absence of his chief, the order of importance would probably be that summarized from the replies to the foundation's first letter.

Without a doubt, too, the qualifications making for the largest success in professional work should be grouped about as indicated in the first reply. This standard —the largest success—was probably in the minds of the members of the professions in sending in their first answers. Instead of thinking of the different kinds of positions likely to occur in an engineering organization, and indicating the qualifications needed for them, they took the larger view and indicated the characteristics needed for the commanding positions. The replies to the second letter will undoubtedly be based upon the same view.

It is well known that the information Professor Mann, who is conducting the investigation for the Carnegie Foundation, is gathering is to be used in connection with a determination of the proper method of engineering education. The question then occurs whether there should be only one type of education for the various types of positions in the engineering world. Undoubtedly there are those who feel that engineering fundamentals can be so taught and combined with liberal studies as to develop simultaneously the qualifications in the first three groups. If that can be done one is willing to admit that a single type of education may suffice. Native talent will, of course, pay a large part in the degree to which any group of qualifications is developed in the individual.

It would be interesting, indeed, if Professor Mann's conclusion should lead to a single type of engineering course. It would be an indication of a return to earlier views, when education was one and individual characteristics were given little consideration. The differentiation in education for the main branches of engineering—civil, electrical, mechanical, mining and chemical—will still persist. The general type is here referred to, rather than the differentiation determined by the fields of engineering.

One Highway Convention—The Manufacturer's Opportunity

FRUITLESS attempts have been made for several years to bring the American Highway Association and the American Road Builders' Association to some understanding which would result in the holding of only one national highway convention annually. The meeting of the road builders at Pittsburgh last week showed clearly, from the temper of those present, that the two associations are not any closer to-day than they were three years ago. If anything, the breach has been widened. It is useless to hope for a single convention as the result of initiative on the part of either of the associations concerned.

Various suggestions for a solution have been made. In one case the formation of a new organization into which the others might be merged has been proposed. The road builders, the older of the two associations, will not listen to any such proposal, and are determined to maintain their separate existence. On the other hand, the American Highway Association has much to give up—in publicity work and in the publication of the Good Roads' Year Book —and if the new association would not continue this work, the loss would be a serious one to the highway field. Unless there is assurance that its broader plans will be accepted it is hardly to be expected that the highway association, with a large bona fide membership, will give up its work. In the opinion of this journal, therefore, it is useless to expect that a single highway convention can be brought about by amalgamation of the existing organizations.

Another suggestion has been that the Association of State Highway Officials invite the other two organizations to meet simultaneously with it. In fact, that association has taken steps in this direction, and will invite the other bodies to meet at one place on the same dates unless they agree, previous to Aug. 1, 1916, on a joint meeting place. This arrangement would allow the two highway associations to maintain their separate identities. It fails, however, to make provision for the road shows, and on this point the two associations would likely split. Both of them depend for a considerable part on revenue from the shows—for enough, at least, to defray the convention expenses. This gives an opportunity for squabbling and is a fatal defect in the state highway officials' plan.

In the judgment of the Engineering Record neither the amalgamation, the third organization nor the state highway officials' plan has any likelihood of success. There is, however, a way out.

The manufacturers can decide the issue without any shadow of doubt. If they will get together and form a manufacturers' exhibition company, taking the management of the show out of the hands of the association officials, the matter is settled. The exhibition company would notify both the American Road Builders' Association and the American Highway Association that it would exhibit at only one show, and would invite the officials of the two organizations to get together and to agree upon a time and place of meeting at which the exhibition company in turn would pledge itself to hold an exhibition. If the two associations failed to agree, the exhibition company would then exhibit with each in alternate years.

The Engineering Record believes that this is the only feasible solution. The conventions cannot afford to do without the shows, which have become a very valuable feature of the meetings. If the manufacturers will stand by their exhibition company and will refuse to yield to the pressure that will be brought upon them, there is no doubt that the organization which would make a first attempt, if it dared, to meet without the show would quickly be convinced of the folly of its procedure.

Without a doubt, too, the exhibition company would be willing to appropriate a certain sum to each association, in order to assist it in defraying the expense of publishing the proceedings, and would see that the proper meeting places were provided.

This journal realizes that some years ago there was an association of exhibitors, and that this association could not be held together. Nevertheless, so disgruntled are manufacturers with the present situation that there is greater likelihood of success now than then. Moreover, the exhibitors, besides saving the cost of the extra display each year, would probably get their space for less, since the exhibition company would operate at cost, plus whatever appropriations were made to the highway organizations.

This proposal of an exhibit company or association is not by any means new in the exhibit field. The machinery and materials exhibits which are held jointly with the conventions of the American Electric Railway Association, the Master Car Builders' Association, the American Waterworks Association, the American Railway Engineering Association, and the American Concrete Institute are financed in every case by exhibition associations or companies. The technical bodies have no hand in arranging for the shows. In fact, the holding of a manufacturers' exhibit is not, and should never have been, part of the work of the highway organizations. It is essentially a commercial matter.

What has been done sucessfully in other fields is possible in the highway field—if only the manufacturers have the backbone to hang together.

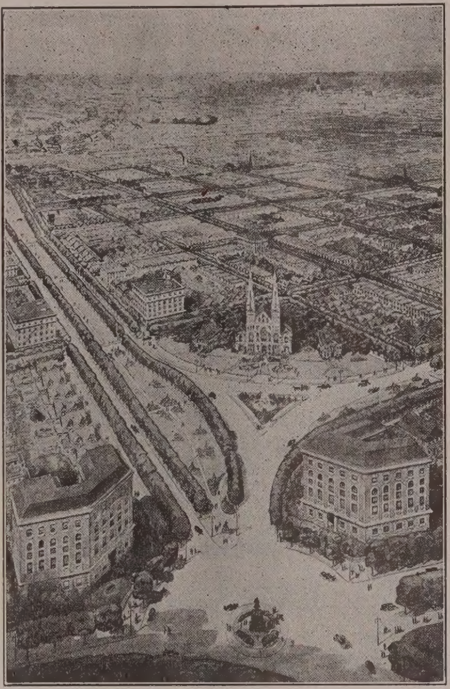
It is time that a stop be put to the dual conventions. The manufacturers have the whip hand. If they will get together and stand solidly against the pressure that will be brought to bear against them, two national conventions a year in the highway field will be a thing of the past.

The influential and energetic manufacturers of road machinery and materials must take the initiative. Highway engineers and contractors, as well as their brother manufacturers, will be their debtors.

City Planning on an Exceptionally Large Scale Is Meeting with Public Approval at Philadelphia

Radical Departures Have Been Made from Old Ideas as to Street Arrangement and Sizes of Lots in Territory to Be Opened Up by $24,000,000 South Philadelphia Improvement

PROBABLY the largest project of comprehensive city planning, as applied to an undeveloped district, ever undertaken in the United States is now being carried out in Philadelphia. This has been made possible by the fact that the $24,000,000 South Philadelphia improvement, described in the Engineering Record of Sept. 11, 1915, page 327, is expected, by the removal of railroad barriers, to open up about 5000 acres of undeveloped city land. In addition to the extensive projects of railroad and pier construction referred to in that article, the ordinance of Feb. 14, 1914, under which the general improvement is being carried out, authorizes "such general revision of the lines and grades of streets as may be necessary to provide for the better service and development of the waterfronts, and more direct and convenient approaches thereto; to provide for proper and adequate facilities for circulation and transportation, and for commercial, industrial and residential development; and to complete the city plan."

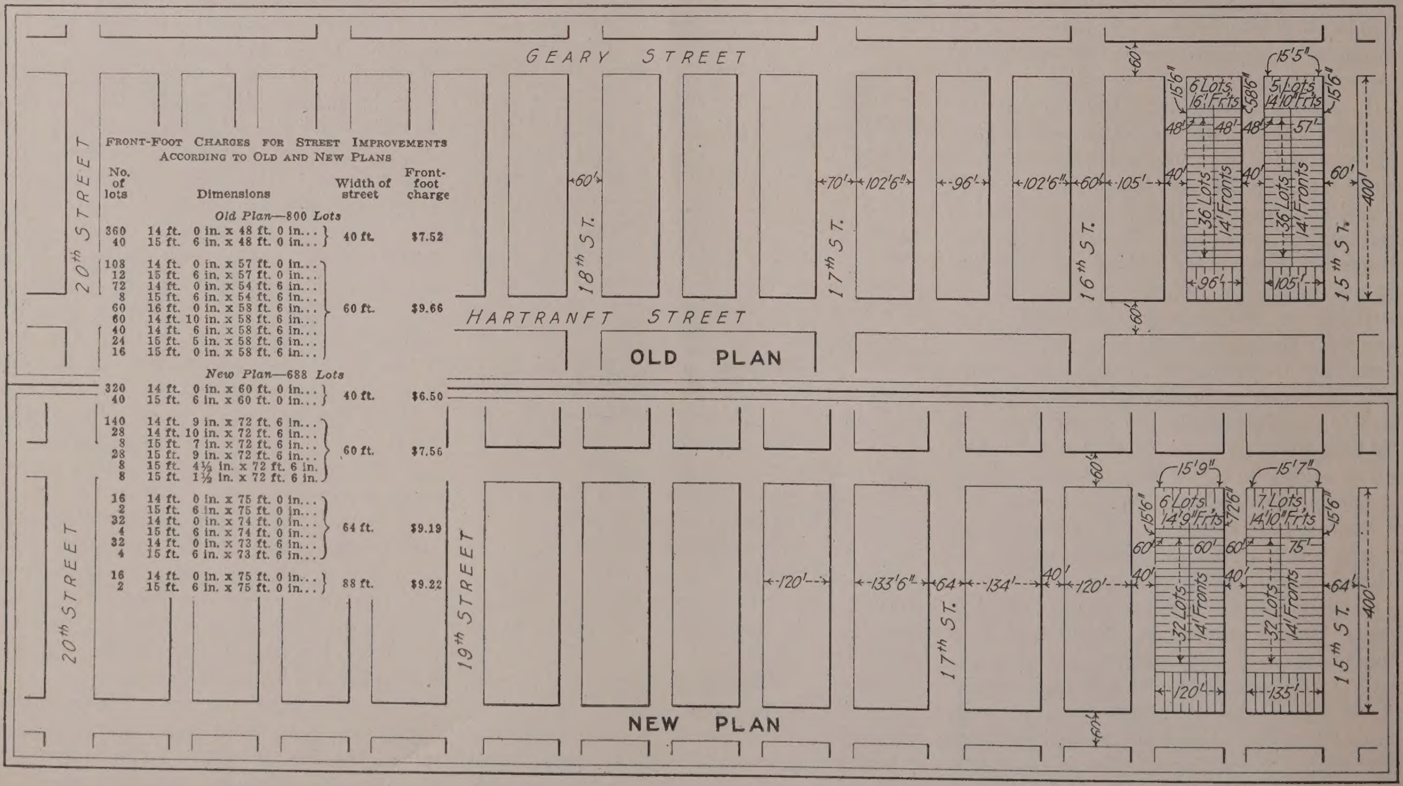


SUGGESTED TREATMENT OF OPEN SPACE AT THIRTY-FOURTH STREET AND SNYDER AVENUE

Long ago a street plan was made for this section, following the same arrangement of uniform rectangular blocks as prevails in the present built-up areas, with nothing to break the monotony except a few diagonal streets. For some years the Bureau of Surveys, Department of Public Works, through its General Plans Division, has been working on a radical remodeling of this plan, with these three principal objectives: A better subdivision of land for industrial purposes and the Philadelphia type of house; the classification of streets by widths and arrangement into main thoroughfares and business streets, secondary streets, minor residential streets, and parkways; and the creation of parks, squares and other open spaces to relieve the monotony of the streets and invite artistic treatment. At first the efforts along these lines met with considerable local opposition but at length the real-estate owners and others saw the desirability of the changes, and they are now actively supporting the movement. The revised plans for 2000 acres have been officially established, and the plans for the remaining area are about completed.

DEEPER BUILDING LOTS

The most fundamental aim of the General Plans Division was to increase the depth of building lots and to encourage more informal schemes of land subdivision. Philadelphia, as is well known, is built up very largely with one-family dwellings in solid rows. This type of development is generally approved and there is no intent to interfere with it. As the built-up part of the city is laid out, however, and as the original city plan was continued into the undeveloped South Philadelphia region, the block distances between main or through streets range from 381 to 400 ft. Dividing one of these blocks with two intermediate streets of a minimum width of 40 ft. gave lot depths often not more than 45 ft., and it is the opinion of the Board of Surveyors that this depth is not sufficient to insure proper housing conditions. On the other hand, with only one intermediate street the lots became too deep, so that the owners found the property difficult to market. Furthermore, lots more than 75 ft. deep are deemed undesirable as they encourage the erection of small buildings behind the houses and lead to the creation of nuisances.



FRONT-FOOT CHARGES FOR STREET IMPROVEMENTS ACCORDING TO OLD AND NEW PLANS

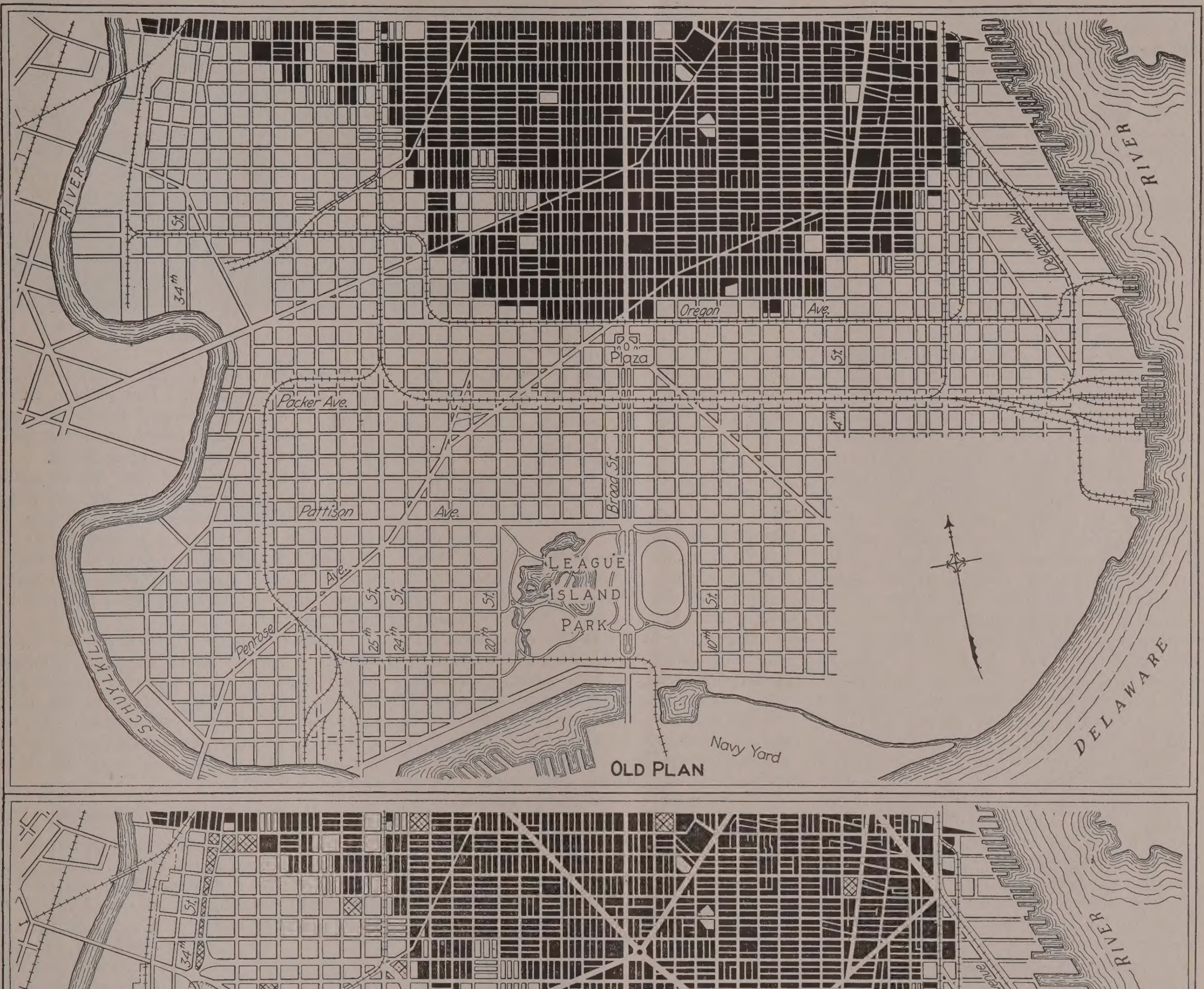
No. of lots	Dimensions	Width of street	Front-foot charge
	Old Plan—800 Lots		
360	14 ft. 0 in. x 48 ft. 0 in...	40 ft.	$7.52
40	15 ft. 6 in. x 48 ft. 0 in...		
108	14 ft. 0 in. x 57 ft. 0 in...	60 ft.	$9.66
12	15 ft. 6 in. x 57 ft. 0 in...		
72	14 ft. 0 in. x 54 ft. 6 in...		
8	15 ft. 6 in. x 54 ft. 6 in...		
60	16 ft. 0 in. x 58 ft. 6 in...		
60	14 ft. 10 in. x 58 ft. 6 in...		
40	14 ft. 6 in. x 58 ft. 6 in...		
24	15 ft. 5 in. x 58 ft. 6 in...		
16	15 ft. 0 in. x 58 ft. 6 in...		
	New Plan—688 Lots		
320	14 ft. 0 in. x 60 ft. 0 in...	40 ft.	$6.50
40	15 ft. 6 in. x 60 ft. 0 in...		
140	14 ft. 9 in. x 72 ft. 6 in...	60 ft.	$7.56
28	14 ft. 10 in. x 72 ft. 6 in...		
8	15 ft. 7 in. x 72 ft. 6 in...		
28	15 ft. 9 in. x 72 ft. 6 in...		
8	15 ft. 4½ in. x 72 ft. 6 in.		
8	15 ft. 1½ in. x 72 ft. 6 in.		
16	14 ft. 0 in. x 75 ft. 0 in...	64 ft.	$9.19
2	15 ft. 6 in. x 75 ft. 0 in...		
32	14 ft. 0 in. x 74 ft. 0 in...		
4	15 ft. 6 in. x 74 ft. 0 in...		
32	14 ft. 0 in. x 73 ft. 6 in...		
4	15 ft. 6 in. x 73 ft. 6 in...		
16	14 ft. 0 in. x 75 ft. 0 in...	88 ft.	$9.22
2	15 ft. 6 in. x 75 ft. 0 in...		

FIG. 1—FIVE PRIMARY BLOCKS REMODELED INTO THREE TO GIVE LARGER LOTS AND MORE FLEXIBILITY

Even on the old plan the desirability of deeper lots on the more important streets was recognized.

The only remedy, therefore, seemed to be a change in the size of the main blocks to permit greater variety and elasticity of subdivision.

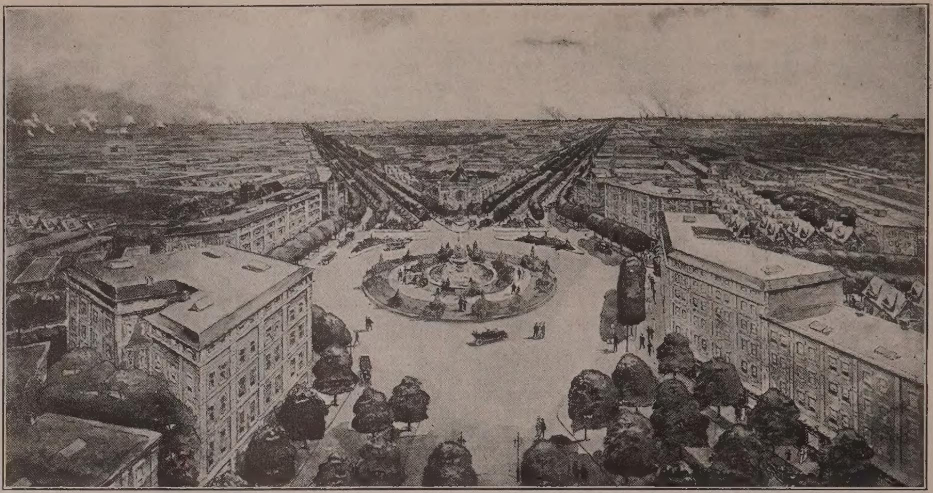
Fig. 1 shows how the streets have been relocated in the area bounded by Geary, Fifteenth, Hartranft and Twentieth Streets, as well as the detail dimensions of some of the building lots in the old and new plans. The changes, it will be noted, are all in the north-and-south streets. The table shows the number and sizes of the



FIGS. 2 AND 3—THE OLD STREET PLAN AND THE NEW—THE OLD, RIGID AND MONOTONOUS; THE NEW, FLEXIBLE AND INTERESTING

lots in detail in the two plans, together with the charges per front foot for the street improvements. These charges are materially less for the new plan, and this fact has proved a potent argument with the real-estate owners.

It may be said that in time to come a different arrangement of the narrow intermediate streets may be made in unimproved areas, and Mr. Haldeman, the head of the General Plans Division, has stated that he would like to see this done, so as to give the property owners an opportunity for adopting informal plans of the garden city or other type not in conflict with the general city-planning laws. The Board of Surveyors concluded, however, that for the time being it would be better to exercise a more rigid control over the situation.



SUGGESTED TREATMENT OF PENROSE PLACE, LOOKING NORTHEAST

CLASSIFYING THE STREETS

Tied up with the question of lot subdivision is that of street widths. Business and traffic usually seek the same street, and as only a few streets can become business streets there is always a tendency toward congestion if the street is narrow; even the proximity of other streets of equal width and availability do not attract travel from the business street. The aim, therefore, has been to select a few streets as main thoroughfares and business streets and fix their widths so that traffic and business will instinctively follow them and have ample freedom of movement. Secondary streets will take a less amount of traffic, while the narrow residential streets will be used for local purposes only. In Fig. 1 Twentieth Street is designed as a main thoroughfare and business street, while Fifteenth, Seventeenth and Nineteenth as well as Geary and Hartranft, the secondary streets.

More diagonal streets are provided in the new plan than in the old. These diagonal streets are expected to carry heavy traffic. With industries ultimately segregated along the waterfront and the belt line it becomes doubly important that they may be reached by direct routes without the necessity of going around two sides of a square for long distances. The diagonal streets are equally important, also, in providing direct routes for trunk sewers, principal water mains and other underground facilities.

These diagonals are not laid out perfectly straight for long distance. Minor deviations such as appear in Fig. 3 add little to their length, but give them character and add to the interest of their perspectives.

OPEN PLACES

To afford variety and give opportunity for the centralization of public buildings for local neighborhood uses, such as churches, schools, libraries and other similar institutions necessary to the civic activities of the community, a number of open places have been introduced in the new plan. An important feature of some of these open places is the intercepting of the north-and-south and east-and-west streets by a sort of loop street, this being done to eliminate sharp angles of intersecting streets and of streets abutting on the open places, and to increase the economic value and usefulness of the frontages of the wider and more important streets. This, of course, means that in general these open places must be located between and not on the main thoroughfares of the rectangular system, so that these thoroughfares will not be cut off.

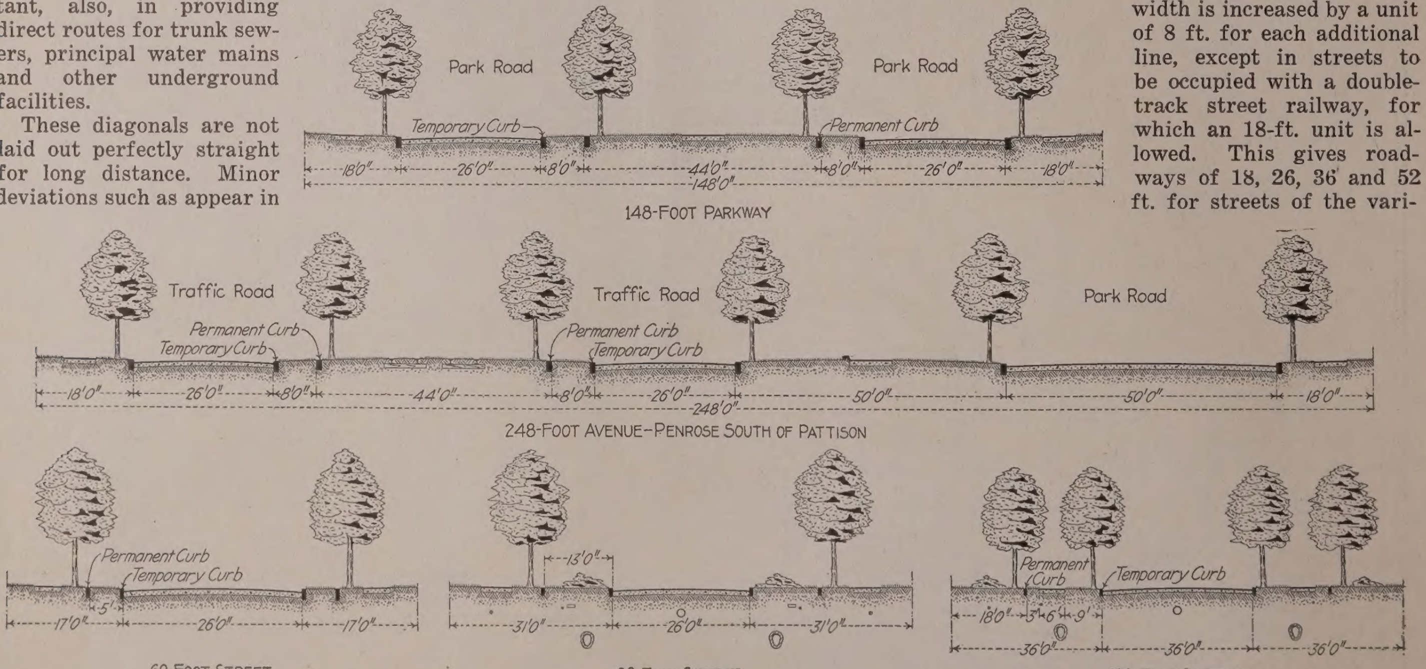
Figs. 2 and 3 show in comparison the old plan and the new for the whole South Philadelphia district. The areas not built up are blackened in. The purely minor streets in the undeveloped section are not shown. Attention is called to the warping of the streets around the open places.

It will be noted that the blocks along the waterfront and the belt line are much larger than those elsewhere. This is to give large industries a chance to locate their plants and expand them as necessity arises without crossing streets, an opportunity they do not enjoy with the present small blocks.

Attention is also called to the large number of small parks scattered through both the built-up and the undeveloped sections in the new plan. Those in the built-up area are already established and the system is being extended through the undeveloped area as the revision of the street plans progresses.

ECONOMICAL STREET WIDTHS

Considerable study has been given to the question of economical street widths, with the result that a number of unusual widths have been adopted. A standard of 18 ft. is used as the width of a roadway for two lines of vehicles, and this width is increased by a unit of 8 ft. for each additional line, except in streets to be occupied with a double-track street railway, for which an 18-ft. unit is allowed. This gives roadways of 18, 26, 36 and 52 ft. for streets of the vari-



148-FOOT PARKWAY

248-FOOT AVENUE—PENROSE SOUTH OF PATTISON

60-FOOT STREET

88-FOOT STREET

108-FOOT STREET

FIG. 4—APPLICATION OF FLEXIBLE PRINCIPLE TO ROADWAY WIDTHS OF VARIOUS CLASSES OF STREETS

Note that both the temporary and the permanent roadways conform in width to the standards adopted by the General Plans Division—18, 26, 36 and 52 ft.

ous commonly used widths up to 88 ft.

For minor residential streets 40 ft. is prescribed by law as the minimum. This is made up by an 18-ft. roadway and two 11-ft. sidewalks. For the 50-ft. streets the roadway is 26 ft. and the sidewalks are 12 ft. each. Sixty-foot streets are in favor, this width allowing 36 ft. for roadway (18 of this being given to car tracks), together with 12-ft. sidewalks. Streets 64 ft. wide are also used, the roadways being the same and the sidewalks 2 ft. wider. Seventy-foot streets are not in favor, as they give an odd number of traffic lines or unnecessarily wide sidewalks.

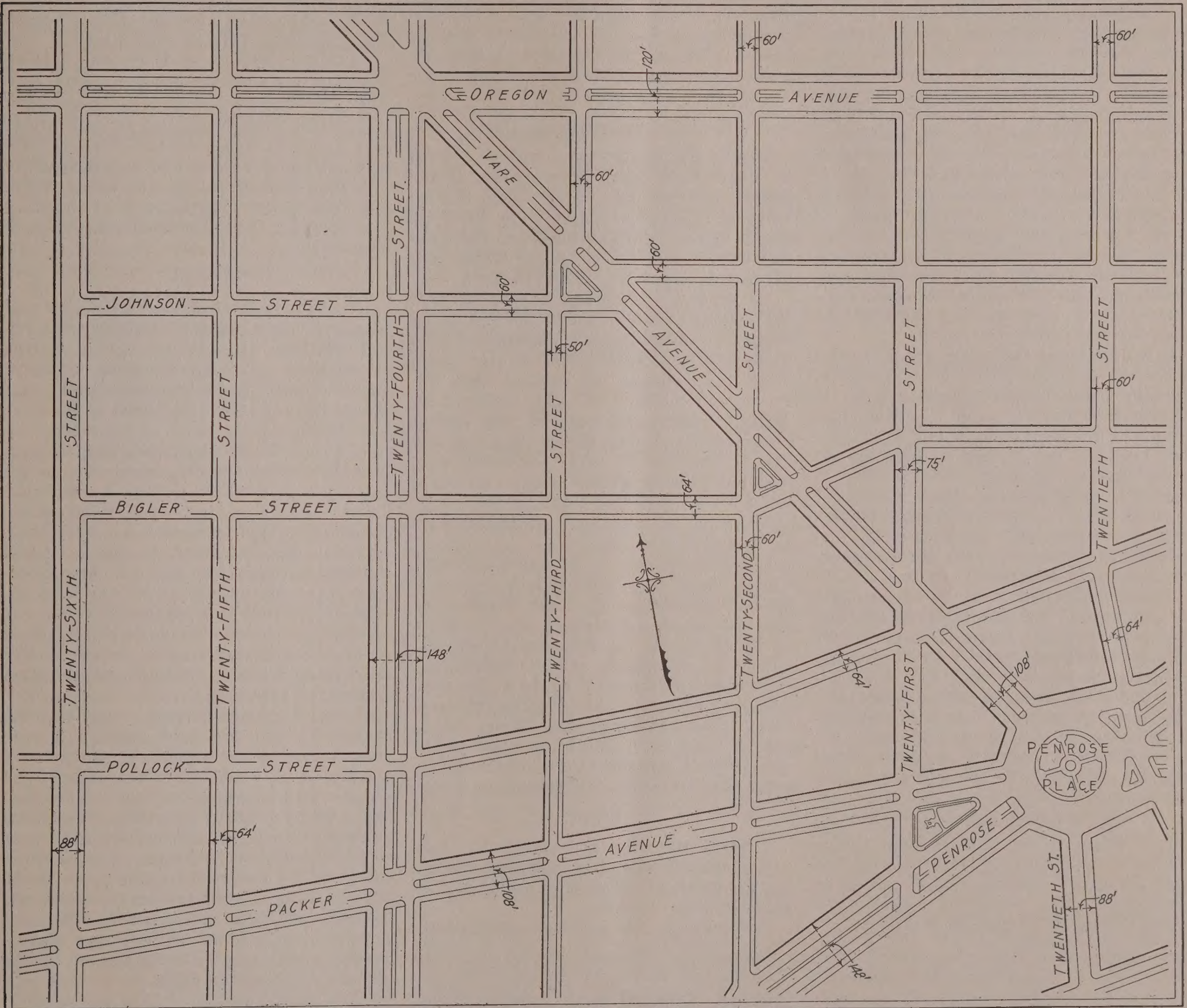


FIG. 5—IN THIS COMPARATIVELY SMALL TRACT PRACTICALLY EVERY WIDTH OF STREET APPROVED BY THE GENERAL PLANS DIVISION IS FOUND

The Division considers 88 ft. an ideal width for business streets, this allowing a 52-ft. roadway (two car tracks and two lines of traffic in each direction) with 18-ft. sidewalks. For some of the diagonal streets expected to carry very heavy through traffic, 108 ft. is the width selected, this giving a 72-ft. roadway, which will accommodate eight lines of traffic or six lines and a double-track trolley line. This is considered about the maximum width for a business street, as business shuns wider streets. Some of the parkways are much wider. Penrose Avenue south of Pattison Avenue being 248 ft. wide, divided up as shown in the middle drawing of Fig. 4.

The elastic principle is being applied to a considerable extent in the street cross-sections by temporarily making some of the roadways narrower than the ultimate plan calls for, this narrowing being based upon the unit widths adopted for lines of traffic. Fig. 4 shows the application of this flexible principle on streets of various widths.

ONE SMALL TRACT WITH ALL CLASSES OF STREETS

Fig. 5 shows the street widths adopted for the section south of Oregon Avenue between Twenty-sixth and Twentieth Streets. This illustrates practically every width used by the Division. Twenty-sixth Street is designed as a business street and main thoroughfare, as shown further on Fig. 3, and is the width believed to be ideal for such streets, 88 ft. South of Penrose Place Twentieth Street is to be a business street and has the same width. At Penrose Place, however, it forks into Vare and Penrose Avenues, leading to the northwest and northeast respectively. Consequently north of this junction Twentieth Street becomes a secondary street, 64 and then 60 ft. wide. Next in importance of the north-and-south-streets is Twenty-first, which is made 75 ft. wide, with a 36-ft. roadway south of Oregon Avenue and a 45-ft. roadway north; this street is a survival of the former plan. Twenty-second and Twenty-fifth Streets, both secondary streets, are 60 ft. wide, and Twenty-third, of still less importance, and offset at Vare Avenue, is only 50 ft. wide. Twenty-fourth Street is designed as a parkway and is made 148 ft. wide, with two 26-ft. roadways and a 60-ft. park space between them.

Penrose Avenue is laid out in a similar way. This avenue is expected ultimately to become a very important thoroughfare paralleling the Delaware River from Philadelphia to Chester, and will probably be occupied by a high-speed rapid-transit line; hence it is likely that the park space will be largely cut down in the future by widening the roadways. South of Pattison Avenue, where the greatest amount of traffic will be concentrated, Penrose Avenue is to be 248 ft. wide. Packer, Vare and Oregon Avenues are intended to be business arteries, and as they are expected to carry very heavy traffic they are made 108 ft. and 120 ft. wide instead of the 88 ft. generally adopted for business streets. Oregon Avenue is also a survival of the former plan. The remaining east-and-west streets are secondary streets 60 and 64 ft. wide. The narrower residential streets dividing up the territory still further are not shown.

ANGLES AND OFFSETS IN SECONDARY STREETS

Attention is called to the numerous angles and offsets in the streets. This is due largely but not wholly to the warping of the street system around the open spaces and to the effort to make the frontage of the main streets more available. The General Plans Division considers it necessary to make only the primary streets direct, deeming it desirable, rather than otherwise, to introduce deviations in the secondary system to give variety and afford the opportunity for small open places and triangles.

A view is shown of the suggested treatment of Penrose Place. It may be mentioned in passing that Penrose Place is not typical of all the open squares, as it is on, instead of between, main north-and-south and east-and-west thoroughfares, and is designed to accommodate the gyratory movement of traffic. The elimination of sharp intersection angles between the streets coming to the square is, therefore, not quite as complete as at the other open places, but this is remedied by making the square larger and utilizing some of the triangles for parking purposes.

It will be noted that there are no curved streets in the city plan. From the city-planning point of view curves are felt to suggest irregular topography and winding ascents of hillsides; hence it is thought that they would be out of keeping with the absolute flatness of the South Philadelphia territory. Furthermore, they would not be acceptable in the development of this territory, which will be commercial and industrial in character, with the one-family row houses in residential sections.

This city-planning work in Philadelphia is being done by the General Plans Division of the Bureau of Surveys, Department of Public Works. B. Antrim Haldeman, assistant engineer, is in charge of the Division, and is assisted by a staff of seven men. The Board of Surveyors has final authority in establishing the plans, and when the street system is confirmed by that body all improvements must be made in accordance therewith.

THE STREAMS OF THE PACIFIC COAST STATES furnish about 40 per cent of the total estimated available water power of the United States, according to a bulletin issued by the U. S. Geological Survey.

Miami Conservancy Plans Are Completed

Project for Protection of Dayton and Adjacent Cities Ready to Be Discussed at Public Hearings

PLANS for the engineering works of the Miami Conservancy District, which includes Dayton, Ohio, have been completed and filed with the directors of the district. They follow in the main the scheme proposed two years ago and described in The Engineering Record of March 28, 1914, page 356. The plan includes the building of five retarding basins, supplemented by channel improvements through the cities. The preliminary plans had called for seven of these basins. The basins, with the channel improvements, will take care of a flood 40 per cent greater than that of 1913.

GENERAL FEATURES OF DAMS

The retarding reservoirs will be formed by dams built across the valleys of the Miami, Mad and Stillwater rivers, and on Twin and Loramie creeks. The total capacity of the retarding basins to the spillway level is 840,000 acre-ft., or 60 per cent of the total rainfall of the 1913 flood.

In general, the greatest rate of flow through the cities below the retarding basins in case of a storm like that of 1913 would be approximately half as great as in 1913. The channel at Dayton when improved and enlarged will have sufficient capacity to carry somewhat less than half as much water as the maximum 1913 flow, and that at Hamilton to carry somewhat more than half; the remainder in each case being cared for by retarding basin control.

The principal dimensions of the dams are given in Table 1.

The highest dam is that at Englewood, 120 ft. above the valley and the lowest is the Huffman Dam, 65 ft. high. For the construction of all the dams, a total of about 9,500,000 cu. yd. of earth and about 190,000 cu. yd. of concrete will be necessary.

The local flood control works at the various cities will consist of widening and deepening channels, correcting sharp bends, raising and lengthening bridges, protecting the sides and bottoms of channels with concrete at critical points, and building levees.

COST

Table 2 gives the estimate of the total cost of each dam, and of each local channel improvement, including the cost of real estate and other damages.

Construction can proceed on all of the channel improvements and on nearly all of the dam construction at one time. Three years of active construction work should be sufficient for the substantial completion of the project.

TABLE 2—ESTIMATED COST OF COMPLETION OF ENTIRE PROJECT

Retarding Basins—	
Germantown	$640,235
Englewood	1,959,632
Lockington	865,218
Taylorsville	1,508,674
Huffman	1,299,125
	$6,272,884
Local Flood Protection—	
Piqua	$128,801
Troy	157,574
Dayton	1,383,619
West Carrollton	22,416
Miamisburg	167,267
Chautauqua	4,283
Franklin	115,076
Middletown	81,305
Hamilton	1,274,962
	$3,335,303
Estimated cost of construction of the works included in the plan	$9,608,187
Public service relocations and damages	2,309,315
Real estate purchases and easements	5,664,200
Administration and general expense	1,758,170
Taxes and special assessments, during construction period, on lands acquired	200,000
Estimated cost without contingencies	$19,539,872
Contingencies	4,000,000
Estimated maximum cost	$23,539,872

TABLE 1—DIMENSIONS OF DAMS AND APPURTENANCES

	Germantown dam	Englewood dam	Lockington dam	Taylorsville dam	Huffman dam
Average elevation bed of river	723	768	876	759	777
Average elevation valley floor	730	782	885	770	785
Elevation of spillway crest	815	876	938	818	835
Elevation of top of dam	830	892.5	954	837	850
Maximum elevation of water surface for a flood like 1913	805	862	936	815	830
Area submerged in a flood like 1913, acres	2,950	6,350	3,600	9,650	7,300
Maximum amount of water stored in a flood like 1913, acre feet	73,000	209,000	63,000	152,000	124,000
Maximum average depth of water in reservoir in a flood like 1913, feet	24.8	32.9	17.4	15.7	17.1
Length of crest of dam, feet	1,210	4,660	*6,400	*2,980	*3,340
Thickness of dam at average elevation of valley floor, feet	650	740	410	390	380
Length of outlet conduit, feet	520	725	45	40	40
Number of conduits	2	2	2	4	3
Total sectional area of outlet conduits, square feet	182	214	158	1,116	705
Maximum discharge of conduits in 1913 flood, second-feet	9,340	11,000	8,630	51,300	32,600
Length of spillway crest, feet	55	100	72	132	100
Vertical diameter of conduits, feet	12.3	13.5	10.0	20.5	17.6
Yardage of earth in dams	865,000	4,000,000	1,135,000	1,235,000	1,655,000
Yardage of concrete in dams and appurtenances	20,000	38,000	38,000	47,000	40,000

*Including spillway crest.

DETAILS

The dams will be earthen structures constructed on the highest standards, with liberal sections. Discharge conduits will be constructed on rock. Concrete spillways have a capacity to discharge safely all excess water in case of a flood twice as great as that of 1913.

A short distance upstream from the entrance to the conduits, rows of concrete piers will prevent large masses of timber from floating to the conduit entrances. Booms, anchored to massive concrete piers, also will be constructed, to catch material drifting on the surface of the water and prevent it from being carried into the conduits. The stream beds and the toes and slopes of the embankments of the dams will be paved at and near the entrance to the conduits in such manner as to provide ample protection against all erosive action.

Below the conduits broad channels with concrete floors and side walls, and wide enough to allow the water to spread out very quickly as it issues from the outlets, will extend down stream for several hundred feet, finally connecting, either directly or through an artificial channel, with the river channels below. The bottoms of these channels will be below the water level in the stream. As a result the water leaving the conduits at high velocities will meet comparatively still water in the larger channel below, a stilling pool being formed by the section of increased depth.

LANDS WITHIN THE BASINS

A flood 40 per cent greater than that of 1913 would cover about 35,600 acres of land in the five retarding basins. Of this area about 20,500 acres were actually flooded in 1913, and a larger area would, of course, have been flooded by a flood 40 per cent greater; so that less than 15,000 acres additional would be flooded by the construction of the dams in case a greater storm should ever occur.

The right to flood this land will be acquired by the purchase of the land or by obtaining easements. The construction of the dams will not result in removing from agricultural use more than a few hundred acres of land at and near the dam sites.

Angle for Concrete Chute Suggested by Committee

Recommendation Made After Tests with Mixes of Different Consistencies—Limit Proposed also for Amount of Water

AFTER studying the effect of different chute angles and different consistencies of mix, the committee on mixing and placing reported to the Second National Conference on Concrete Road Building at Chicago two weeks ago that the least angle for chutes should be 20 deg. and that the maximum amount of water should be 6 lb. per cubic foot of loose materials.

In beginning its work the committee looked into the matter of chute paving mixers, against which objection had been made. Opportunity then being afforded through the courtesy of the T. L. Smith Company, investigations of a machine of this type were made, at Milwaukee, by the committee. The machine used was the new Smith-Chicago Paver, No. 507, the capacity being 7 cu. ft. per batch, wet rating. (For description of this machine, see the Engineering Record of Feb. 19, 1916, page 268.) A 12-ft. chute was used, the full length being in service practically throughout the tests.

COMMITTEE'S CONCLUSIONS

As a result of its studies the committee reported that the chuting method when properly used is good. The pitch of the chute should be steep enough to deliver concrete of a proper consistency readily. In the attempt to cover considerable area contractors are likely to set the chute at a flat angle and use too much water in order to make the concrete flow readily. The committee believes, as a result of the tests, that the least angle should be approximately 20 deg. and the maximum amount of water should be 6 lb. per cubic foot of loose materials. With this quantity of water the concrete ordinarily will not flow fast enough for the average contractor on the slope recommended, but after a little time the material flows faster, owing to the smoothing of the chute by the grinding and cleansing action of the wet concrete. It is better to increase the pitch of the chute than to increase the amount of water.

The committee expressed the hope that before the next conference all of the leading mixer manufacturers will have arranged for a test of a battery of mixers of the principal types. Such a test should be arranged so that loose materials can be fed from one bin in certain predetermined quantities and be mixed for the same length of time. It should also consider the size and shape of mixer drums, the form of mixer blades in the drums, the speed of the drum for the best results and all the prominent features which now enable salesmen to put forward selling arguments in favor of a particular mixer. Until such a comprehensive battery test can be made the committee believes that the following points should be observed in mixing concrete for road work:

1. The mixer drum should revolve at a speed not exceeding sixteen revolutions per minute.
2. The minimum number of revolutions for each batch to be ten.
3. The minimum length of time for mixing each batch to be one minute.

TIME OF MIXING

The reason for fixing one minute as a minimum is that in the tests referred to it was found that the water was not worked through the mass as it should be in less than one minute. This is a point which has never been mentioned to our knowledge but it is of importance. A much smaller quantity of water can be used with long-time mixing than with short-time mixing, and the same degree of fluidity obtained. It is necessary therefore to have each batch mixed not less than one minute if the amount of water mentioned as a maximum is to be used.

When the batches mixed for less than one minute were discharged, there was a marked difference between the first and last concrete discharged. In ordinary work, owing to the very large quantity of water used per batch, this has not been marked enough to cause comment. Rapid mixing requires considerable water to secure uniformity in appearance of the mixed concrete and as the quality of concrete is usually judged by the eye too much water is used.

PERSONNEL

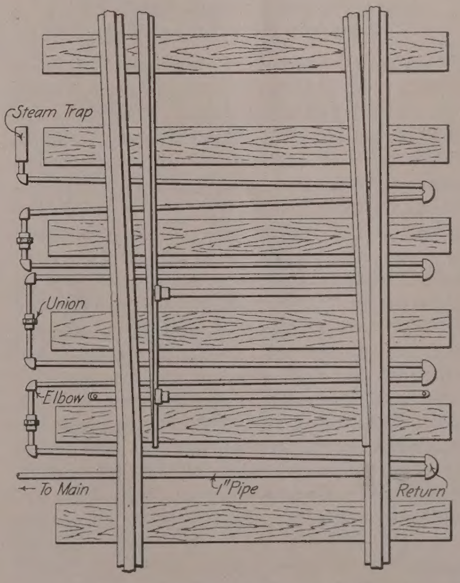
The personnel of the committee was as follows: Ernest McCullough, consulting engineer, Chicago, chairman; John Wilson, consulting engineer, Duluth; Ernest Ashton, chemical engineer, Lehigh Portland Cement Company, Allentown, Pa.; G. E. Scott, contracting engineer, Norwalk, Ohio; A. D. Williams, chief engineer, West Virginia State Road Bureau, Morgantown, W. Va.

Steam Piping Protects Erie Switches from Snow and Ice

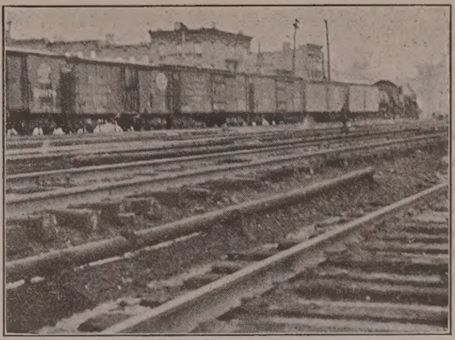
By L. A. FRANCISCO
New York City

JUST WEST of Grove Street on the Erie Railroad is an installation of steam piping to heat switches. Two 9-ft. lengths of 1-in. pipe connected at one end by a standard return form one section or hairpin. Four of these sections connected by elbows, nipples and unions form the protection for one switch. The elbows, nipples and union connect the hairpins around the ends of the ties, giving a spread of about 15 in., as shown by the accompanying sketch.

The units are passed between the tees under the rails and on top of the ballast, which is scooped out a little to accommodate them; on the end of the last section is placed a Sarco or Hines steam trap to take care of the condensation. The first section is connected to the main by a 1-in. pipe. The mains run along one side of the yard for some two blocks, as shown by the accompanying photograph, and are supported on ¾-in. saddle irons, which are stuck into vertical sockets of 1-in. pipe. The mains are 2-in. pipe covered with insulating material and having a sheet-metal covering, the whole clearing the ground about 6 in.



ARRANGEMENT OF STEAM PIPING



MAINS RUN ALONG YARD FOR ABOUT TWO BLOCKS

The steam is furnished by a locomotive which is coupled on when the weather warrants it. The coil sections are removed in the summer.

Recommends $2,500,000 Garbage Plant for New York

Works on Rikers Island, Having Capacity of 2800 Tons Daily, Will Revert to City After Five Years' Private Operation

IF the recommendations of John T. Fetherston, commissioner of the Department of Street Cleaning of New York City, are adopted, the garbage of the boroughs of Manhattan, the Bronx and Brooklyn will be disposed of at a new $2,500,000 plant to be constructed by Gaffney, Gahagan & Van Etten on a city-owned site at Rikers Island and operated by these contractors under a five-year agreement, the plant reverting to the city at a sale price of $1,500,000. The contractor is to finance the construction of the proposed works, for it is stated that the city, at the present time, is not in a position to provide the necessary funds. The contractor's net operating profits, it is estimated, will exceed $575,000 per annum. When the city takes over the operation of the works at the end of five years it will realize, for a further period of ten years, an average annual net profit of $527,500. The proposed plant is to have a daily capacity of 2800 tons and will utilize the Cobwell system of garbage treatment, which is employed at New Bedford, Mass. Before making his recommendations for New York, Commissioner Fetherston inspected the New Bedford works and his findings were made public recently in a report to Mayor Mitchel, the source of the following notes.

NEW BEDFORD PLANT OPERATION

In addition to the power plant for the production of steam, there are only three types of apparatus used in the Cobwell method: (1) The so-called reducer, which is essentially a closed, steam-jacketed kettle, with a revolving arm or agitator, used for stirring the garbage. (2) Condensers for liquefying water and gasoline vapors. (3) Vaporizing tanks or stills, consisting of closed vessels, steam heated, for the purpose of separating grease from gasoline or naphtha. Other parts of the process consist of the usual conveying machinery for transporting raw garbage from the reception point to the reducers; grinders with screens and conveyors to grade the tankage or fibrous residue.

At the New Bedford plant 30 tons of garbage are delivered daily in wagons. When a charge of about 8 tons of green garbage is placed in the reducer the opening to the reducer is closed and the process started in operation by flooding the garbage with low-grade gasoline or naphtha-petroleum. Steam is then turned into the jacket, which encloses the lower portion of the reducer or kettle, and the agitator is likewise started in operation. The steam enters the kettle at about 60 lb. pressure, and the temperature within the chamber occupied by the garbage and gasoline is maintained below 200 deg. Fahr. The application of steam heat causes moisture in the garbage and vaporized gasoline to pass off from the kettle into a so-called vapor line, and thence to the surface condensers, where cold water reduces the temperature of the mixed vapor (water and gasoline)and liquefies water and gasoline, which pass into a settling tank, the gasoline occupying the upper portion of the tank, while the water is retained in the lower portion of the tank up to a certain level; the excess water passes from the tank to the sewer. Commissioner Fetherston examined this effluent water from the garbage and found it to be practically odorless, and with only a very slight tinge of color. The effluent, in his opinion, would not constitute a nuisance, and would in reality carry less odor than ordinary household sewage.

Gasoline Acts as Solvent

After the moisture is driven from the garbage the temperature in the reducer rises, thus indicating that the process of abstracting the moisture is complete, and the material is in suitable condition for the abstraction of grease. There are three general products resulting from the treatment of garbage: (1) moisture, amounting to approximately 70 per cent by weight of the original garbage; (2) about 4 per cent by weight of grease; and (3) about 26 per cent by weight of solid material, consisting mainly of vegetable and animal fibre, but containing about 5 per cent of bones, glass, rags and crockery. The valve leading to the vapor line is closed after moisture is evaporated and gasoline is pumped through the fibrous or solid residue until the material receives three or four washings with liquid gasoline, which acts as a solvent and carries off the grease to the vaporizing tanks or stills, where heat is applied to the mixture of grease and gasoline, the gasoline being driven off, condensed and returned to the storage tank therefor, the grease remaining in the still until it is pumped to the grease storage tank for shipment to market. This portion of the process, involving the extraction of grease, is entirely enclosed and the grease at no time is exposed to the atmosphere. No nuisance, it is believed, can result from this portion of the process.

After the solid material in the reducer has had the moisture and grease abstracted live steam is injected into the mass of "tankage" (solid or fibrous residue) for a short time, and the door on the side of the reducer is opened, the agitator or paddle started in operation and the tankage for the first time appears exposed to the atmosphere of the room. The odor in the immediate vicinity of the pile of tankage, the report states, was not objectionable, and 10 ft. away from the mass no odor was perceptible. Any odor which might arise from the tankage discharged from the reducer did not reach the outside atmosphere, though the mass of tankage was within a few feet of two open doorways. The process of eliminating the moisture and abstracting the grease from the garbage, as well as drying the tankage, was all performed in one piece of apparatus which remained closed during the entire time the process was in operation. Only the moisture from the garbage and the tankage were exposed to the atmosphere at the conclusion of the process, and neither the garbage water nor the tankage was at a temperature sufficiently high above that of the surrounding atmosphere to drive off vapors containing odorous gases.

In the new Cobwell system, according to Commissioner Fetherston, inefficient operation will result in the loss of profits, which reverses the conditions obtaining under other methods, so that simplicity in design in this case will force efficient operation and corresponding elimination of odors.

Commissioner Fetherston concludes his report with this statement: "I have compared all the details of the proposed Cobwell system with those of other methods of garbage disposal, both by the so-called cooking process (Barren Island, Columbus, Cleveland, etc.) and the direct heat drying method with percolation by gasoline and no cooking (Chicago), and I believe that in sanitary effect, as well as commercial return from the treatment of by-products, the Cobwell system commands the greatest advantages, more especially from the sanitary standpoint, and that a plant using this system can be operated within the limits of New York City without creating any nuisance due to the escape of odors, fumes, noxious gases or odorous liquids."

Strong opposition to the plant location on Rikers Island has been voiced by real estate interests and taxpayers.

Concrete Slabs Used at Railroad Crossings

Grade Intersections at Cedar Rapids, Iowa, Made Smooth by Premolded Slabs 8 Feet Long and 24½ Inches Wide

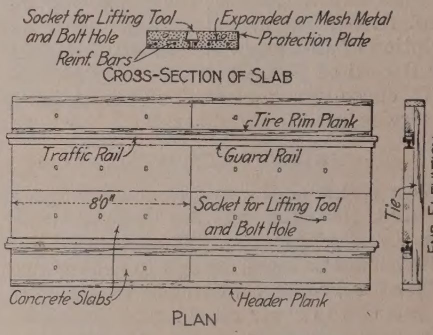
SLABS of premolded reinforced concrete are used in Cedar Rapids, Iowa, for making smooth grade crossings. The slabs are used in pairs, each slab being 24½ in. in width by 8 ft. in length. With proper expansion joints they exactly fill the space between the rails. The thickness is made the same as the height of the rails so that vehicles pass over without a jar. Lewisohn sockets cast in the slabs permit removal by a tripod or by carrying bars usually found in the tool box of a section gang, in case the supporting ties need replacing or electrical connections are in need of repairs.

A letter from T. F. McCauley, city engineer, states that the first crossing was installed on the interurban railway that passes by the city barn and is in as good condition practically as when installed. The second one was placed last September on the Chicago, Milwaukee & St. Paul Railway tracks on a street that carries a heavy storage-house traffic. This one was installed by the section crew. They used a guard rail that was too deep, and as a result they had to force the slabs into place by using an oak tie as a battering ram, with the result that they crushed the edges of the slabs. However, they have gone through the winter without any apparent further damage.

Nothing Needed to Hold Slabs in Place

In installing the slabs no device was used for holding them in place. They were merely laid on top of the ties and at the ends stakes were driven or an end piece was spiked to the ties to keep the slabs from being disturbed. Their weight seems to be sufficient to keep them in place. If necessary, however, it is pointed out that a screw bolt could be placed through the sockets into the ties.

The slabs were made in the city barn of 1 part cement to 2 parts sand, of a rather wet mixture, in an ordinary wood form. They were allowed to harden for thirty days before being hauled to place. It seems to be impossible, says Mr. McCauley, to find a satisfactory pavement for the space between rails, or rather for the entire space over the ties where the track foundation is a resilient one, and it is hoped that this slab construction will turn out to be an improvement over ordinary methods of paving.



DETAILS OF CROSSING SLABS

[Concrete slabs for city pavements that must be removed at intervals were suggested in an editorial in the Engineering Record of April 18, 1914, page 434. Perhaps there are other instances of the use of premolded slabs on such pavements. A discussion of them in these pages is invited.—Editor.]

Gross Operating Revenues for December, 1915, on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1,253 per mile, showing an increase of $260, or 26.2 per cent as compared with December, 1914. Operating expenses were $802, an increase of $72, or 9.9 per cent. Net operating revenue, therefore, was $451—an increase of $188, or 71.7 per cent, and operating income was $398—an increase of $180, or 82.3 per cent. Like the November figures, the above figures compare the highest and lowest Decembers in six years; the increase of operating income in December, 1915, over the average for the five previous Decembers was 49.6 per cent. The operating ratio was 64.0 per cent, as compared with 73.5 per cent in December, 1914, and 73.4 in December, 1913. Considering the three main districts, the representative ratios for December, 1915, and December, 1914, were as follows: Eastern district, 67.4 and 79.3; Southern, 63.3 and 71.1; Western, 60.5 and 68.5.

National Defense—For Engineer and Contractor

Second Article of Series Describing the Pioneer Troop's Duties, Methods for Speedy Work, Assignment of Tasks and the Tools and Equipment Which Least Impede Mobility

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army

THE duties of engineer troops in the United States Army in time of war may, with respect to location, be classified as follows:

1. At bases, mobilization camps and advance supply depots.
2. On the line of communications.
3. In the attack and defense of fortified places (siege operations).
4. With the mobile army in the field.

Each of these is further capable of subdivision, and may include a great variety of works. Duty with the mobile army is the prime function of engineer troops, and is the one on which their organization, training and equipment should primarily be based. All other engineering duties, except, possibly, siege operations, must be regarded as special. They will, when necessary, be performed by engineer troops, either regular or volunteer, with such changes or additions in personnel or equipment, civilian assistance, etc., as the special situation or exigency may demand.

Photo. Am. Press Ass'n.

"THE INTRENCHMENTS OF THE FIELD ARMY ARE OFTEN QUITE ELABORATE, BUT THEY ARE IN GENERAL LOCATED AND PREPARED IN HASTE AND ARE LATER ELABORATED AND DEVELOPED TO MEET THE TACTICAL NEEDS OF THE SITUATION"

ENGINEER OPERATIONS CLASSIFIED

The engineer troops for field service should be with the combatant forces at the front, at all times subject to the immediate orders of the commanders of the divisions or armies to which they may be attached. Their duties will be intimately connected with the movements and tactical operations of the fighting forces and should be characterized by extreme rapidity, full use of local resources and a thoroughness all sufficient unto the immediate needs, but *no more* than sufficient. Subject to these conditions, the operations of the field engineers may be roughly classified as follows:

1. Operations to facilitate the rapid movement of the combatant forces.
2. Operations to increase the offensive or defensive powers of the combatant forces and to limit or decrease those of the enemy.
3. Operations to maintain the health and promote the comfort of the troops.

In brief, these duties may be classed as, (1) transportation; (2) fortification; (3) sanitation—in short, conserving and promoting the operating efficiency of the troops.

It is of the utmost importance in every case to draw the line of demarcation between the duties of the field engineers at the front and those which properly pertain to the engineer or other personnel on the lines of communication. This is necessary in order to insure smooth co-operation and the presence in every tactical emergency of the mobile engineer troops with the combatant forces. The supreme commander in the field will in each case prescribe and limit the functions of the two organizations. Those of the field engineers should include no work which might have been performed by others. There will be enough which they alone can execute, and their energies should not be frittered away on work for which other troops or civilians are or might be made available.

The more important special duties of engineer troops in the mobile army may include:

1. Reconnaissance of the natural and cultural features of the terrain, preliminary to tactical operations, or for other purposes, and reconnaissance of hostile works and dispositions.
2. Collection of maps and other data from local sources.
3. Correction and amplification of existing charts.
4. Mapping of limited portions of the terrain within the sphere of tactical operations and other minor survey duties.
5. Map reproduction, field methods.
6. Collection and utilization of local engineering resources in personnel and material.
7. Laying out of defensive positions and points of support.
8. Planning and superintendence of offensive or defensive field fortifications, including obstacles, sapping and mining, etc., and the execution of the more difficult tasks in connection therewith.
9. Laying out and improving camps.
10. Sanitation, including water supply and sewage disposal.
11. Construction and repair of roads, railroads and bridges.
12. Construction of temporary buildings and repair of permanent buildings and other structures.
13. Military demolitions.

The ideal engineer troops are those prepared to execute all tasks which may be assigned them, and the engineers of the United States Army are trained with this end in view. In the field they must not only meet but anticipate the needs of the army. To this end the chief engineer should be at all times in close touch with the commander-in-chief and with the engineer troops, and each battalion and company commander of the engineers must be at all times in close touch and hearty co-operation with the troops of the line with whom he is serving.

SPECIALIZATION UNDESIRABLE

On account of the variety of duties exacted of an army in war, we find a strong tendency in many countries to specialize the work of the technical troops. By this is meant that certain organizations are trained to perform a certain kind of work and are not supposed to be employed in anything outside of their specialty. Thus we find in the European armies sapper companies, railroad companies, aero companies, telegraph companies, etc. One foreign engineer has even recommended the organization of water-supply companies.

In our own service the duties of the foreign, aero and telegraph companies fall to the Signal Corps. All the remaining technical field operations demanded by the modern army are to be performed by the engineers—an entirely feasible arrangement. If we were to have special troops for each technical duty there would be no limit to their numbers. Moreover, many of these duties are sporadic in their nature and the troops trained to perform them would necessarily be idle a large part of their time, or else, which is more probable, they would be assigned to other duty, for which they should have been trained. So far as our own service is concerned, a multitude of special troops would be a useless expense, and our engineer companies can and should be trained to perform satisfactorily all the engineering operations required by the mobile army, including the mapping of limited portions of the terrain, the construction of temporary buildings, water supply, the hasty repair of railroads, etc. A single organization large enough to have representatives with every command, from a brigade up, is thus always available and qualified to perform any task that may be assigned. Extensive work of a special nature, excepting siege operations, will generally be executed in the rear of the army, and special provisions therefor can be made as the occasions arise.

QUICK RESULTS ESSENTIAL

Military engineering, as we have seen, is an adaptation of civil engineering to military needs. The fundamental difference between the two arts is in their economic aspects. In civil engineering the element of first cost is of prime importance. The matter of time consumed in construction is of importance as a rule only as affecting the first cost and the financial returns on the investment. A considerable time spent in design and other preliminaries to construction will usually be amply justified by a material saving in first cost.

Such are the economics of civil engineering. Those of military field engineering are very different. The cost of a modern war between two great nations is enormous—estimated at about $100,000,000 per day, not including incidental losses to industry and commerce, for all the European belligerents. The price of success is great enough—that of failure is usually much greater. A few days—even a few hours—have decided the issue of a battle and the fate of a nation. Accordingly, the march of events is rapid in modern warfare. Everything must move with the utmost celerity. Time is the controlling element. The commanding general does not ask his engineer, "How much will it cost?" but "How soon will it be ready?" The rough and ready makeshifts which serve their purpose are the triumphs of the military engineer's art. They have the beauty of utilitarianism.

USE ANY MATERIAL AT HAND

Suppose that it is war time and an army approaches a stream. Its mission is to cross the stream and seize an important position on the other side before the enemy can reach and hold it. The engineer with this force is called upon for a bridge to replace the one that has been unexpectedly destroyed. "It must be ready by day after to-morrow," the Commanding General informs him, "or my opportunity will be lost." Unlike the civil community, the army cannot wait for its bridge. The engineer finds that no suitable lumber is at hand, but he perceives a number of costly buildings whose demolition will furnish what he needs. The owners protest their destruction. The engineer is well aware that they will place claims for many thousands of dollars against the government, but he realizes the vital need for the bridge and rightly considers the cost as insignificant by comparison. He is not restricted to the available funds of a small community, but has at his back the vast resources of a great and wealthy nation which demands results. The buildings are demolished, in spite of protest, and the bridge is built on time. The army accomplishes its mission, which proves to be a contributing cause of ultimate victory.

The two chief essentials of military field engineering, then, are: (1) The adaptation of engineering work to tactical needs; (2) appreciation of the economics of warfare, which ordinarily demand high speed in construction, even at a sacrifice of money and life.

Only the simplest works can be successfully executed in the haste and excitement attendant upon field operations. In the forefront of operations, often actually under fire, construction can and must be carried on under conditions which would be exceedingly discouraging to the average civilian engineer or contractor. It is the simplest works, comparatively few in number, which will most frequently be demanded. It is for the execution of these simple works that engineer officers and troops should primarily be trained.

AIDS TO SPEED

The methods by which speed in construction may be attained constitute a study which no engineers, military or civilian, can afford to neglect. Formal plans are rarely used. Ordinarily nothing more than simple sketches is required. These consist of an instantaneous adaptation of military type plans to the materials, tools and labor available. All details which increase the time required for construction without being absolutely essential to the completed structure are eliminated and the remaining details reduced to the simplest form. Unless construction plant is available, which will seldom be the case, very large pieces should not be used. All pieces should be of such size that they can be readily obtained and easily handled by the men with the assistance of animals and simple tackle.

It is not to be supposed indeed that all military field engineering is in the nature of sudden emergencies. Frequently the need of certain structures can be foreseen days or weeks in advance, and when this is the case careful and elaborate preliminary arrangements may be possible.

In starting work the necessary tools are laid out and steps taken in advance to have all necessary material on hand as soon as it may be required. The work should then be divided into a number of definite tasks under the officers and senior non-commissioned officers, and these again subdivided into smaller tasks, under the junior non-commissioned officers. The cost of superintendence, which might be prohibitive on civil work, is justified in military construction if it results in a saving of time. If several of the tasks can be made similar in nature and equal in amount, so much the better. This will create competition, always a stimulus to endeavor.

It should never be necessary to have any men idle, except when they are actually resting. There always will be tasks in connection with any piece of work, the performance of which will not tire the men as much as standing around, which is very fatiguing. Extra non-commissioned officers should be put to work, on the more dignified tasks, of course. They should not be allowed to get the idea that their sole function is to superintend. The foreman of any particular task should, when practicable, be given a specific time in which to complete it, usually the least time in which the task can possibly be accomplished. While he may fail to complete it on time, he will naturally be anxious to avoid the explanations that will then be demanded of him. If no time is set for completion dawdling is very apt to result. Two gangs mutually dependent upon each other, as where one furnishes the material which another incorporates in the structure, should be so organized that each will be hard pushed to keep up with the other. This is in the nature of competition. If the number of tools is limited, care should be taken that all tools are doing useful work all the time.

NO USE FOR HEAVY PLANT

It has frequently been remarked that military engineers make very little use of construction plant in their field operations and they have been criticised for not availing themselves of it to a greater extent. Plant is utilized in military construction whenever practicable, but in operations with the mobile troops at the front the opportunities for its useful employment are decidedly limited in number. Such plant is, of course, less useful on the light, hasty military structures than on the heavier and more formal works of peace. The work of the military engineers is spread over a considerable area, they move rapidly from place to place, and they must at all times keep up with the mobile fighting forces. Heavy construction plant is not sufficiently mobile to meet such requirements. Often it would not be on hand when needed. One of the chief purposes of such plant is to save manual labor, and of this there is seldom a dearth in military operations. The military pioneer is greatly concerned in preserving his mobility, and accordingly must not be unduly hampered in his movements by the necessity for transporting heavy machines. This is especially true in America on account of the deficiency in good roads. Therefore, he places his chief reliance on the most mobile and adaptable of all machines—man himself.

In the occupation of a defensive position, each soldier intrenches his own section of the line. It is quite apparent that the troops can be disposed in the position and can complete the excavation, each man using his own portable tool, in a few hours of time. In such a situation, trenching machines could not compete with manual labor. If concrete be employed in such intrenchments, it would be distributed in small masses over a considerable distance. Neither large nor small machine mixers would be as rapid and efficient as hand mixing.

"THE ROUGH AND READY MAKESHIFTS WHICH SERVE THEIR PURPOSE ARE THE TRIUMPHS OF THE MILITARY ENGINEER'S ART"

For the more formal work in rear of the fighting forces, however, conditions will be different and plant may be more frequently employed. Such works would include roads, railroads and bridges on the lines of communication, buildings at supply depots, the preparation of secondary lines of defense, the rather deliberate fortification of important cities, arsenals, supply depots, etc. Here labor will be less plentiful than at the front, more time will be available, and structures of a somewhat more permanent nature will be appropriate. The intrenchments of the field army are often quite elaborate, but they are in general located and prepared in haste and are later elaborated and developed to meet the tactical needs of the situation.

The foregoing considerations will also make evident the economic necessity for utilizing to the greatest possible extent the construction materials which are available at the site. The necessity of bringing materials from a great distance would often cause most injurious delays. Accordingly, earth, timber, brush, gravel, etc., will be the favorite materials, and works should be designed to utilize these so far as possible. Accessory materials of construction which must be transported to the site should be of a portable nature. Chief among these will be cordage, nails, spikes, wire, barbed wire, etc.

Mobility a Prime Factor

The principal construction work of the combatant troops will be intrenching. For this work the troops are supplied with special miniature shovels, picks, mattocks, saws and hatchets, which are carried on their persons. More efficient work could, of course, be performed with the commercial types of tools, but these must be carried in wagons or motor trucks and often would be missing when most needed. "The soldier," said Napoleon, "should never be separated from his rifle or his intrenching tool." What was true in Napoleon's day is more true in this day of trench warfare. The operations of the engineers being more varied, they require a more elaborate equipment. But it must never be forgotten that mobility is a prime requisite, and neither the infantry nor engineers should be hampered in their movements by the transportation requirements of an unnecessarily elaborate equipment.

The tools and equipment of the engineers may be divided into two classes: (a) Commercial types of tools and materials. (b) Special tools, apparatus and equipment used only by the army. Under (a) would be included the great bulk of engineer equipment, not including the ponton material. Under (b) would be included such equipment as cannot be readily obtained on short notice in the commercial markets—ponton material, the miniature intrenching tools issued to the infantry, tools for military mining and other siege material, wagon and pack equipment (army standard), portable map reproduction outfits, etc. An ample reserve of the second class (b) should be kept on hand at all times, as there would be a considerable delay in obtaining this in sufficient quantity on short notice, in the event of war, on account of its "special" nature. An additional source of supply, besides arsenals and home markets, is the immediate theater of war, whose resources should be utilized to the fullest possible extent.

Tools for pioneer work, like the structures built therewith, should be of the simplest character. A man trained to their use can do excellent work with the simplest tools. The standard pioneer tools and supplies of the engineers should include picks, mattocks, crow-bars, axes, adzes, shovels (mostly D hdl., r.p.), hammers (asstd.), machetes, hatchets, saws, two-man saws, wire cutters and pliers, a few light jacks, augers (large sizes), a few short rock drills, canthooks or peavies, pulley blocks (up to four sheaves), a couple of small chain blocks, lanterns, marline, rope for lashing and tackle (⅜-in. is a good size for lashing, ¾ to 1-in. good for tackle, nothing larger), wire (10 to 14 AWG—a copious supply), spikes and nails, various sizes. There should be flat and round iron for straps, bolts, driftbolts, dogs, etc., a little tool steel, some tapped nuts of same sizes as round iron, and washers (wrought), machine and black oil and oil for lanterns, one or two light portable forges and anvils with a little coal, a couple of grindstones, leather, etc., etc.

In addition to these general tools and supplies, there should be several small and compact carpenter outfits, a simple blacksmith's, machinist's and horse-shoeing outfit, a farrier's kit, saddler's and shoemaker's equipments, sketching instruments (to be carried on persons of sketchers), a couple of light transits (to be used also as levels), stadia rods (used also as level rods), a number of metallic tapes, 50 and 100 ft.; a simple plumbing kit, twine, tracing tape (for laying out intrenchments), a demolition outfit (40 per cent dynamite is the handiest explosive), a camera and simple photographic supplies, a simple drafting and map reproduction outfit, a field desk and portable typewriter for the company office, etc.

Transportation of Equipment

The entire equipment is ordinarily carried in wagons divided into compartments to permit ready accessibility. It should, however, be such that it can be carried on pack mules, in which case survey instruments, photo equipment and the smaller and more delicate tools, such as carpenter's outfits, are packed in boxes of a suitable size. Each company of engineers ordinarily includes a section of mounted men and a small pack train carrying their equipment. In very rough country, where wagon transportation is impracticable, the entire equipment would be carried on pack mules. There should be an ample supply of the more common tools (especially picks, axes, mattocks and shovels) so that when occasion arises the labor of other troops or of civilians can be utilized. Most of the tools and materials listed above should be carried by each company of engineers, but some of them will be needed only with battalion headquarters.

With this simple equipment the engineers can perform all the operations which will ordinarily be required of them, utilizing such materials as may be found at hand. Beyond this it does not seem advisable to recommend any standard equipment, except the regular ponton bridge equipage. There is a large number of special tasks for which special equipment may be used to advantage. Such equipment should be obtained locally or sent forward from the base as it is needed. Plows and scrapers are most useful for road work, intrenching, and many other tasks. In a civilized country they can be obtained in almost any locality. For simple railroad repairs a few claw and tamping bars, track jacks, spiking hammers, wrenches, hack-saws, track drills and a "jim-crow" rail bender will be sufficient. Traction and hoisting engines and the commercial types of trenching machines may be used to advantage in fortification work and almost any heavy construction. They can not, of course, accompany the engineers in their more rapid movements, but for big jobs in one locality they may be sent forward when needed.

The battalion headquarters may carry some equipment in addition to that of the companies. Extensive survey work and map reproduction should preferably be under the immediate charge of the battalion commander; the equipment therefor, especially lithographic (zincographic) outfits being with battalion headquarters, operated by special skilled men.

For rapid communication between the separated portions of an engineer command, engaged at section work at various localities, a small micro-telephone outfit and a few bicycles should form part of the company equipment. All engineer officers should be mounted. The development of the motor truck will greatly increase the efficiency of engineer troops, making possible the more rapid transportation of tools and materials. It has also made possible the transportation of small, compact gasoline power plants, which may have a wide field of usefulness. Up to the present time few such plants have been developed, inasmuch as the present war is the first in which the automobile has been extensively employed. Among the possible gasoline power plants for military purposes are the following: Portable searchlights, winches, hoists, drills and boring machines, saws, trenching and mining apparatus, concrete mixers, stone crushers, etc. Very little has been done along these lines and there is room for great improvement.

[*The next installment of Major Bond's articles will deal with stream crossings by means of ponton and truss bridges—one of the most important phases of the military engineer's work.*—Editor.]

Check Dams Subjected to Extreme Flood Test in Southern California

RESIDENTS in the district below Haines Canyon in southern California, where check dams were built to prevent the rapid run-off during heavy rains, affirm that the plan is eminently successful. For thirty years there have been floods from the canyon as often as the rains came, it is stated, but this year, with the check dams in service.

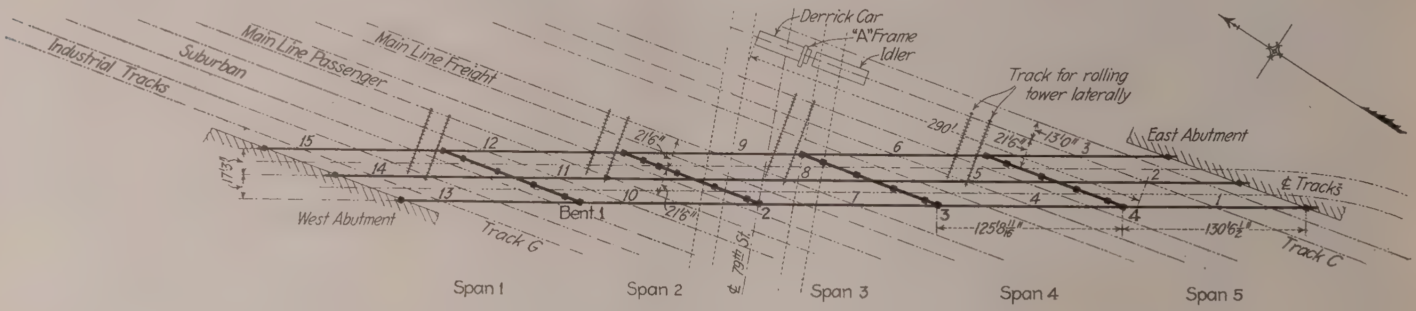
Haines Canyon now has 427 small dams, a complete account of which appeared in the Engineering Record of Aug. 14, 1915, page 204, and although these represent the completion of the work in the upper half of the canyon only, they sufficed to prevent serious effects from the heavy storms of the present season, during which more than 16 in. of rain have already fallen in that section. During the rains the stream from the mouth of the canyon was never so large that school children were unable to cross it easily. When the check dams are finished throughout the entire length of the canyon it is expected that the storm run-off will be entirely absorbed by the cone at the canyon's mouth.

Since the work in Haines Canyon was undertaken, more than a thousand other check dams have been built on private lands in the vicinity. One estate in this district has more than 100 dams, each of which is now retaining its pool of water where preceding seasons left simply the eroded gorge.

Special Steel and Timber Erection Tower Places Heavy Plate Girders

Longest Girders in World Erected for Nickel Plate Railroad Bridge Over Illinois Central in Chicago by Specially Designed Rigging

UNUSUALLY GOOD RECORDS were made in the erection of the long heavy plate girders in the New York, Chicago & St. Louis (Nickel Plate) Railroad over the Illinois Central Railroad tracks at Seventy-ninth Street, Chicago. Special erection rigging was designed to handle the 113-ton girders, which exceeded the capacity of any wrecking crane or derrick car with sufficient length of boom to handle them. Some of these girders are of record-breaking length, the end span being 130 ft. 6½ in. long, the longest ever built. The center girders are nearly 126 ft. long and 10 ft. 10 in. deep; their weight of 113 tons is less than the previous record-holding girders at Worcester, Mass., on the Boston & Albany Railroad, which weigh 170 tons, though only 122 ft. long.



PLAN OF NICKEL PLATE RAILROAD BRIDGE SHOWS ORDER OF PROCEDURE IN ERECTION OF GIRDERS

Three-Level Crossing

Near the center of the bridge both railroads cross Seventy-ninth Street, forming a three-level crossing. The Nickel Plate bridge is of the through plate-girder type with solid ballasted floor, three girders spaced 17 ft. 3 in. on centers being used in each of the five skew spans, making fifteen girders in all to be erected. The span lengths were all the same, 125 ft. 8 11-16 in. on centers, except the record span of 130 ft. 6½ in. at the east end.

The problem of safely and rapidly erecting these girders from cars on the tracks of the Illinois Central Railroad without unnecessary interruption of traffic was solved by the use of a special heavy timber and steel tower illustrated in the photographs. This tower was so constructed that by taking out the connection bolts a 15-ft. "gate" section in the west leg could be removed in order to clear the girders when sliding the tower laterally to its next position. Removable transverse braces were placed below this "gate" just before it was taken out, thus stiffening the tower and making a solid base for the cantilever above.

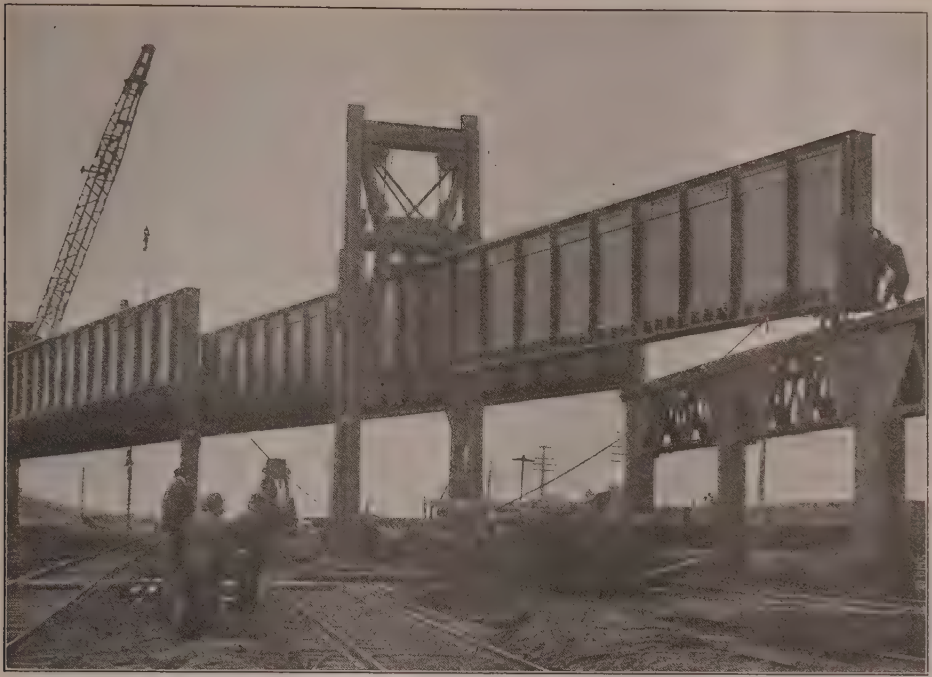
The tower was first erected by a derrick car on the Illinois Central Railroad track *C* to clear the tracks, and was skidded along parallel to the track to its position 1 to erect the south girder of span 5, as noted on the accompanying plan. The tower was then blocked up in this position and the temporary bracing in the lower part removed. The girder was run in on track *C* under the tower, picked up and turned about 20 deg. and placed in its final position. Power was furnished by a derrick car anchored to the track about 300 ft. north of the tower.

The temporary lower bracing was then replaced, the gate section removed and the tower skidded along until it reached position 2 for erecting the middle girder of span 5. The gate section was then replaced, the temporary bracing removed and the second girder placed in position as before. After the erection of the three girders of span 5, the tower was moved clear of bent 4, both the gate section and the temporary bracing were bolted in place, and the tower was skidded over the temporary track under span 4, and the erection carried out as before. The erection then followed in the order given by the number on each girder.

Rapid Progress Made

After about ten days' delay, which was experienced on reaching span 3, because the lower level bridge over Seventy-ninth Street was not sufficiently complete to proceed, the tower erection continued at the rate of a girder a day, an extra day being required in each case to move the tower laterally across the tracks.

The tower was designed to permit traffic on immediately adjacent tracks, and only when steel was actually being raised or the tower was being moved was more than one track blocked to traffic. A 30-ton crane working upon the new bridge followed up the tower and placed the I-beam floor and other light parts. Just two months after the first steel was unloaded at the site the



SPECIAL TOWER PLACING HEAVY CENTRAL GIRDER IN NICKEL PLATE BRIDGE, CHICAGO

erection tackle was unloaded and shipped away from the site.

A total of 2488 tons was placed in the bridge, the girders varying in weight from 86 to 113 tons. Each long girder was shipped from the shops on four flat cars, two middle spacing cars, and two end cars of 150,000-lb. capacity carrying the weight of the girder.

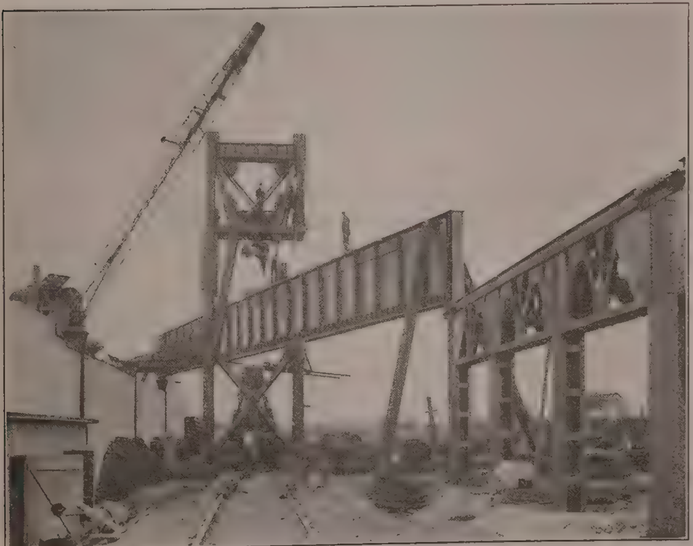
UNUSUAL DESIGN FEATURES

The design of this bridge is unusual in the use of steel columns in the end abutments, surrounded and braced by the concrete and carrying the end girders. In this way the length of the girders could be made less than would be required for a full bridge-seat bearing on top of the concrete abutment. As every inch increases in span length caused a large increase in the bending moment and cost of such record-breaking girders, this device was found to be economical.

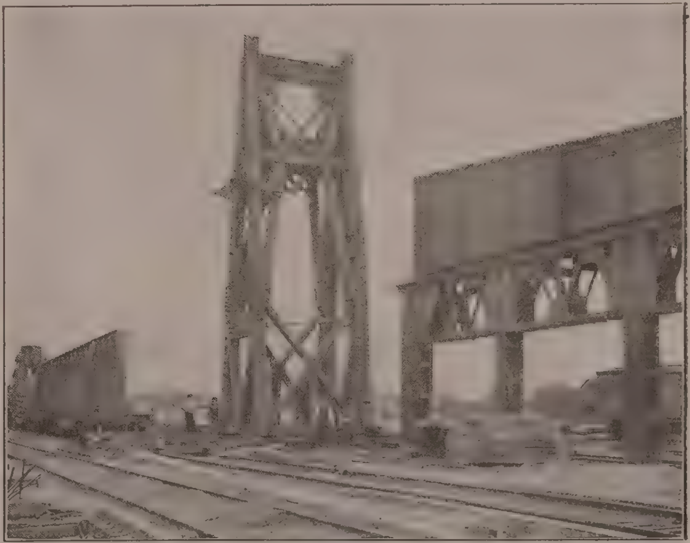
Expansion was provided by fixing the central girder span 3 and the adjacent girders at bents 2 and 3, allowing expansion both ways on top of the other bents and the abutments. Owing to railway clearance requirements, no longitudinal bracing or brackets could be used. The expansion bearings, instead of being the usual roller and rocker type, are made of special steel castings, with oil grooves, sliding on the cap plates of the columns. The castings contain cylindrical projections which engage the hollow cylindrical casting fixed to the girder.

The erection was planned and the special tower designed by the erection department of the Pennsylvania Steel Company, of Steelton, Pa., contractors for the steelwork of the bridge, under the supervision of E. E. Hart, chief engineer, and G. H. Tinker, bridge engineer, of the New York, Chicago & St. Louis Railroad.

THE SUPPLY OF FLINT PEBBLES for the sand-cement plant at the Elephant Butte dam of the United States Reclamation Service has been cut off since the war began, according to the March *Reclamation Record*. Canadian pebbles were purchased, with decreased efficiency, and in the latter days of the operation basalt pebbles were used, but proved very unsatisfactory.



GATE IN TOWER REMOVED WHILE SKIDDING LATERALLY PAST GIRDER



MOVING TOWER FROM SPAN 3 TO SPAN 2—GIRDER ON CARS AT LEFT

Settle Waterworks Valuation Without Litigation

Engineers in Maine Case Make Notable Savings in Time and Money as Compared with Usual Protracted Court Appeal and Appraisal

AT A CONFERENCE at Brunswick, Me., Feb. 10, between Frederick H. Fay, of the engineering firm of Fay, Spofford & Thorndike, Boston, representing the Bath (Me.) Water District, and W. B. Getchell, engineer of the Maine Water Company, of Augusta, it was agreed that the plants, property, rights and franchises of the water company in the county of Sagadahoc and the town of Brunswick should be taken over by the Bath Water District at a price of $539,500, with interest on this sum from Jan. 1, 1916, at 6 per cent. The agreement is the first in Maine, and so far as known in New England, in which the award is less than the total reproduction cost of the physical plant, and it exemplifies a method of settling waterworks valuation disputes which has never before been utilized in any major water case in the state. By engineering arbitration the price of the system has been agreed upon within about four months of the passage of a referendum authorizing the taking of the works by the Bath Water District. Protracted legal proceedings and a court appraisal have been avoided, and a satisfactory settlement attained without the necessity of a third arbitrator. It is estimated that the actual saving to the Water District in interest charges, legal expenses, experts' fees and other outlays exceeds $40,000.

By chapter 197 of the private and special laws of Maine, of 1915, the Bath Water District was created and authorized to purchase and administer the supply system of the water company. During negotiations the two interests agreed that the question of reproduction cost of physical plant, depreciation and water rights should be left to the engineers on both sides. After examination and appraisal of the waterworks system by the engineers it was determined that the cost of reproduction, new, as of Jan. 1, 1916, of the physical plant, excluding (a) real estate, rights of way, tools and supplies on hand, (b) depreciation, (c) water rights and (d) going concern value, was $544,491. The value of water rights was agreed upon as $5,000, and rights of way, tools and supplies totaled $14,516, making a total of $564,007, subject to modification in taking account of depreciation and going value.

Engineer Arbitrators

These conferences ended in a disagreement between the two sets of engineers who took part as to the depreciation allowance, and accordingly the trustees of the water district and the water company agreed to arbitrate the final price through Messrs. Fay, and Getchell, provision being made for the selection by them of a third arbitrator in the event of a disagreement. It was agreed that the two arbitrators should appoint a time and place for private meeting outside of Bath, Portland or Augusta; that prior to this meeting both parties should have the right to furnish any evidence deemed apropos to Messrs. Fay and Getchell; that each party should pay the fees and expenses of its representative and share those of a third arbitrator, if such should be named. Both parties recognized the advantages of avoiding litigation and a court appraisal in placing the settlement of the case in the hands of their engineers. The result of the arbitration was the above-named price of $539,500, with interest, or $19,507 less than the total reproduction cost.

In previous cases, where the parties have been unable to agree and have been obliged to resort to a court appraisal, the final price awarded has averaged about 1.5 times the amount of reproduction cost. In the case of eighteen water districts in Maine and Massachusetts in the past few years the average award has been 54 per cent in excess of the reproduction cost. The accompanying table gives the reproduction costs and prices awarded in several New England water district cases:

REPRODUCTION COSTS AND PRICES AWARDED IN SEVERAL NEW ENGLAND CASES

Place	Reproduction cost	Award	Ratio, award to reproduction cost
Gardiner, Me.	$132,000	$245,000	1.85
Waterville, Me.	368,546	503,475	1.37
Augusta, Me.	287,279	427,135	1.48
Kittery, Me.	102,510	163,869	1.60
Livermore Falls, Me.	85,394	117,698	1.38
Portland, Me.	2,853,696	3,963,034	1.38
Gardner, Mass.	165,000	274,000	1.66
Athol, Mass.	206,386	316,500	1.53

The cost of arriving at the valuation in the Portland case was $152,000 for the municipality and $130,000 for the proprietary water company; in the Gardner, Mass., case the total cost was $72,390; in the Waterville case, $80,600; in the Augusta case, $78,000; and in the Gardiner (Me.) case, $27,317. In the case of Brunswick, Me., the reproduction cost was $130,455, the award $196,162, and the total expense, $41,500.

Basis of Agreement

The price at which the Bath supply system is acquired, based on the average operating expenses for the past ten years, indicates that the district, under proper management, should be able from the first to pay all operating charges, interest on bonded debt, yearly sinking fund of 1 per cent and have an annual surplus of about $5,000. The district will receive all water rates collected by the company since Jan. 1, less the actual expenses during the period.

To save the cost of employing an expert accountant it has been agreed that this accounting shall be done by the superintendent of the water company and by the clerk of the district, referring any disputed questions to Walter S. Glidden, counsel for the district. This accounting will take but two or three days. The trustees of the district were desirous of making immediate arrangements for marketing a bond issue to finance the purchase, a step which could not have been taken satisfactorily at this time had a court appraisal been resorted to instead of the engineering arbitration. The trustees feel entirely satisfied with the result, and the water company has expressed itself as thoroughly gratified with the method and solution of the problem adopted. It is expected that early in the present month the district will be in full possession of the property.

Shall the American Society of Civil Engineers Move Its Headquarters?

Views of Prominent Members on the Important Question Now Awaiting the Decision of the Society

[In its issue of Feb. 5 the Engineering Record presented a summary of the proposal to have the American Society of Civil Engineers move its headquarters in New York to the Engineering Societies' Building. In the editorial discussion in the same issue it invited engineers to send their views for publication. An invitation was also extended by letter to present and former officers to express their opinions.

A number of the replies are presented below. Those of William Barclay Parsons, William J. Wilgus and Palmer C. Ricketts oppose the removal. On the other hand, John R. Freeman, Henry G. Stott, Gardner S. Williams, Hunter McDonald, John A. Bensel and James H. Edwards favor the proposal.

Additional replies will be published in later issues.—EDITOR.]

Gardner S. Williams, Formerly Vice-President and Director of the Society, Favors the Proposal, Seeing in It Great Good for the Profession.

The invitation extended to the American Society of Civil Engineers by the three other great national engineering societies, to join with them in the occupancy of an enlarged Engineering Societies' Building on Thirty-ninth Street, New York City, brings the former face to face with a situation of large and far-reaching possibilities. In submitting to the membership the question whether to accept or to decline the invitation, the board of directors has placed upon every engineer in the society a personal and serious responsibility.

The question as submitted now, based on the invitation of the other societies extended of their own free will, is materially different from that voted upon and rejected 12 years ago, when the proposal was the outcome of the conditions of a gift.

Whatever doubts there may have been as to the possibility of the societies living in harmony under one roof, or of the financial success of the plan, are now reasonably well cleared up by the fact that three of the societies have so lived for over a decade, and have accumulated a "Repair and Depreciation Fund" of $70,000.

That the decision of the American Society of Civil Engineers to remain in its own quarters on Fifty-seventh Street was wise, the writer firmly believes, for in the solution of the problems confronting them the character and strength of the other societies have been more firmly developed than would have been the case had they been able to lean upon the civil engineers, while the latter, by their assertion of independence of the munificent gift of a generous patron, attracted to their membership many of the influential men in the sister societies.

But times and conditions have changed. The separate organizations, at one time extremely jealous each of the other, have come to realize that each has its field and that outside of, and over, and above all is a demand for a spirit of unity and co-operation that was only a dream 12 years ago. This is an age of combination and organization. The medical fraternity of the country through its co-ordination of national, state and county medical societies, exerts a power both socially and politically which enables it to secure any reasonable legislation that may be demanded, either state or national. It is unnecessary to more than refer to the bulwarks a united legal profession has built around its functions and practices. The engineers must take these lessons to heart and profit by them if the profession is to receive in the future that recognition to which the importance of its work in the past entitles it. In other words, the engineers must get together, stay together and work together. To such an end the occupancy of quarters by the civil engineers in the same building that houses three other great national engineering societies, as well as a dozen more or less of allied technical organizations will unquestionably conduce.

This does not contemplate any amalgamation of the American Society of Civil Engineers with the other societies so far as the functions it has hitherto exercised are concerned, but in the writer's mind it is a step and a long one toward the creation of some form of organization, in which, through society representation or otherwise, the interests of upward of fifty thousand engineers and allied craftsmen in the United States, scattered from Maine to California, from Florida to Alaska, may be intelligently guarded, and their influence brought to bear upon the great social and economic problems which this twentieth century is presenting for solution.

William J. Wilgus, Formerly Director of the Society, Favors a Change of Headquarters, but Not as Proposed.

It is with pleasure that I give to you my views on the society house matter of the American Society of Civil Engineers, as I am decidedly of the opinion that a change should be made, although not in the direction that is proposed.

Beyond question the society house is too small, poorly located and so ill-lighted as to have a most inhospitable and depressing effect upon the visitor.

I am not in favor of the use of the Engineering Societies' Building, because I feel that the American Society of Civil Engineers is in such a strong position financially that there is no need for the acceptance, indirectly or otherwise, of a gift from any one outside of its own circle. This, of course, is a purely personal view on my part, as the idea of the society not providing for its own home is repugnant to my sense of independence.

Therefore, because of the need for a change of quarters and also because of the strong financial condition of the society, I am in favor of the purchase of a suitable location in or near the business center of the city, and the erection thereon of a commodious and attractive structure, with adequate provision not only for the present needs of the society, but also for a reasonable time in the future, the spare space not needed at first to be rentable for office or other remunerative purposes.

Without having gone into the matter in detail, it seems to me that, possibly with the aid of many of the members of the society, among whom I would be glad to be numbered, a fund of sufficient size could be raised to finance this project, thereby retaining for the society its independent position, which I hope that it will not sacrifice.

Wm. Barclay Parsons, Formerly Director of the Society, Suggests Single Engineering Organization and Opposes Proposed Plan.

My view is that the American Society of Civil Engineers should retain its own house and its entire separate identity, unless it would be possible to merge all the societies into one American Institution of Engineers. The profession should stop dividing itself up, as it has done, into a multitude of small units. The law and medicine do not make that mistake.

Until a concrete proposition of this sort can be brought forward to merge the societies, I am opposed to the civil engineers moving from Fifty-seventh Street.

John R. Freeman, Formerly Vice-President and Director of the Society, Heartily Approves of Plan.

As one who has enjoyed membership in the American Society of Civil Engineers for thirty-three years past and who has also been active in other engineering societies and a great believer in their usefulness, I am earnestly in favor of the American Society of Civil Engineers joining with the other national engineering societies in the use of the Engineering Societies' Building in New York. There are many good reasons why we should "get together". Among those which appeal to me personally are the following:

1. That the closer contact thus gained with members of allied professions will help in advancing the appreciation of the engineering profession in this country. In several trips abroad, and particularly when attending the annual meeting of the Verein Deutscher Ingenieure in Leipsic, two and one-half years ago, I have been impressed with the better appreciation of the profession by the public abroad, and in the case of the verein this has seemed to me in no small part due to the presence of engineers, from all branches, in one great body.

2. In the Engineering Societies' Building I believe we have the opportunity to build up the best engineering library in the world and one in which the availability of a collection of books pertaining to all branches can be brought to the distant member by a system of research and prompt service, with abstracts and photographic copies of texts, more efficiently if organized on a large scale on behalf of all the engineering societies.

3. I believe the advancement of the profession, the helpfulness of older members to younger members, and the helpfulness of specialists in one branch to those in another branch can be best effected by means of a strong central organization, in which the civil engineers should have their fair share; and that in course of time affiliated with this central organization, the local societies at each of twenty, or perhaps fifty, engineering and industrial centers throughout the North American continent should be encouraged to carry on the work that can best be accomplished by a local society, but all in harmony.

4. The facts appeal strongly to me, after years of interest and activity in these matters, that in the United Engineering Society and its building and in the Engineering Foundation and in the great central library, we have a machine admirably adapted to promoting the interests of the profession in the broadest possible way, and that it is best at the present time to get together on the fundamental principles involved and trust to the application of common sense with engineering experience in course of time to smooth out or mend petty obstacles and loose joints.

In any great movement one must trust more to the spirit which animates than to the precise and elaborate verbiage of articles of association.

Already the matter has been shaped up on broad lines which appear fair and liberal to all concerned, and I believe it better to get together at once and to trust something to the future intelligence of those whom we elect to represent us in carrying on this closer union.

Hunter McDonald, Past-President of the Society, Adduces Arguments in Favor of Removal.

To my mind the proposition admits of little room for argument on the negative side, unless the material interests of the American Society of Civil Engineers are to be given consideration to the exclusion of the professional interests of this society and the profession at large.

In the annual address which I delivered at Baltimore in June, 1914, I gave my views upon the importance of co-operation among all engineers for the good of themselves, the profession and our country. In the same address I also gave my views as to the wisdom of remaining in the present quarters of the society.

At that time I did not know that the doors of the United Engineering Building would ever be again opened to us, and it was not until January, 1915, at the time of the annual meeting that I was advised by Clemens Herschel that there was a probability of its accomplishment. I at once expressed to him my entire approval of the project.

The building which we now own has served a useful purpose, and the society has grown and prospered under the wise management which conceived and carried out the plan, but many changes have taken place since this building was completed. Other societies have grown in importance and numbers. The number of engineers not connected with any of the national societies has vastly increased. Engineers are at last beginning to realize that they, more than any other profession, have it in their power to shape the destiny of our country.

A thorough co-operation of the engineering forces of Germany has made possible her remarkable exhibition of prowess and resistance.

I believe the time has come for the American Society of Civil Engineers to put aside all material considerations in the effort to bring about unanimity of thought and action among all the engineers of this country, and I regard the removal to the Engineering Societies' Building as the first and most important step in this direction.

It will be unfortunate if the matter is defeated or is decided by a close vote. I sincerely hope it may be carried by an overwhelming majority. There is no doubt but that there will be opposition, but I believe it will arise largely through misunderstanding. There may also be discussion of the material interests involved, and if such develops it may become bitter and acrimonious. The announcement by the board of direction of the suggested plan shows that the material interests are about balanced between moving and remaining where we are, but if the proposition is defeated, I shall continue to advocate a building, which will bring in an income commensurate with the value of the location we now occupy.

John A. Bensel, Past-President of the Society, Approves of Plan.

Permit me in the first place to state that in my opinion the Engineering Record is performing valuable service to the engineering profession by opening its columns to the discussion of the arguments for and against the proposal to have the American Society of Civil Engineers join with the other national engineering bodies in the use of the Engineering Societies' Building in New York.

I believe the subject one of grave importance not only to the society, but to the profession as a whole and therefore welcome the opportunity offered by you for an expression of my views.

I am strongly of the opinion that it would be to the advantage of the American Society of Civil Engineers as a body, as well as to the profession as a whole, for it to join the other societies in Engineering Societies' Building, but I do not propose to enter into any discussion as to the saving that would ensue by such a course, as I think the question should be decided along lines of what is best for the profession, with but little reference to the gain or loss in a financial way in continuing our separate existence or joining the other bodies as proposed.

Whatever may be the satisfaction derived from the practice of a profession that comes entirely from its performance, the question of the position of the profession in the minds of the public is one that cannot profitably be neglected. There now is presented an opportunity for civil engineers to join with others whose education, tradition and professional aspirations are those possessed by all engineers irrespective of the particular branch of engineering under which they may be enrolled. It is certainly a fact, so far as the public is concerned, that the home of the profession is in the Engineering Societies' Building, and if the civil engineers were to join the present amalgamation they would thereby not only add to the public estimate of the engineering profession as a whole, which is desirable as a stimulant to professional effort, but also be the gainer as a separate body in the larger recognition that would follow. Personally I have long been of the opinion that engineers have gone too far on both educational and society lines of separation, and that we should get some form of amalgamation of all engineers into one organization and that this would be to the benefit of the profession as a whole. Probably at this time the movement could be begun, if all branches of the profession were identified as one by the public by being housed at one location.

The above reasons seem to me ample to justify my point of view, but, in addition, I think it will be conceded that, so far as convenience is concerned, the location of the Engineering Societies' Building is more convenient as to general access from downtown and for out-of-town members than the house in Fifty-seventh Street. It is conceivable, too, that financially a scheme could be worked out in the change that would show greatly to the advantage of the American Society of Civil Engineers.

Palmer C. Ricketts, Director of the Society, Opposes the Plan.

It seems to me that it would be difficult to induce the American Society of Civil Engineers to give up its Fifty-seventh Street property, and probably to some extent sacrifice it, in order to move to another building in New York City. If it had had no house and little property at the time the union under one roof was contemplated, the proposition would have been different. The same reasons hold now which were pertinent then regarding the change. It can, of course, act now with the other societies in any undertaking where unity of action is desirable, practically as well as if it were on Thirty-ninth Street.

James H. Edwards, Formerly Director of the Society, Believes the Plan Should Be Adopted.

I am heartily in favor of this proposition. The main reason why I am in sympathy with the move is that I feel that engineers of all branches of the profession should come more closely in touch with each other, and exert all the influence possible (which can best be done by co-operation) to place the engineering profession on a proper basis. The work of the engineer, no matter whether looked at from the practical or the theoretical standpoint, is becoming so general that no particular branch can lay any claim to superiority. I hope the time is not far off when engineering will be recognized as one great profession and the different independent divisions as they exist to-day will be considered as sub-divisions of the general profession.

Henry G. Stott, Formerly Director of the Society and Past-President of the American Institute of Electrical Engineers, Favors Removal.

Inasmuch as the actual cost of operating the present building and the proposed quarters will be practically equal, and the investment of the society will be substantially less under the new plan, the discussion seems to be narrowed down to the question: Will the new home improve the status of the society?

I believe the answer to this should be in the affirmative, for the following reasons:

1. The present home of the society is quite inaccessible from a transportation point of view, when compared to the Engineering Societies' Building on West Thirty-ninth Street.
2. Many of our members are also members of the Engineers' Club, which adjoins the Engineering Societies Building.
3. The close proximity of the New York Public Library on Fifth Avenue tends to establish the character of the neighborhood.
4. The fact that the society will be under the same roof as the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Institute of Electrical Engineers will strengthen the bond between these societies, and tend to united action when occasion demands co-operation.
5. Have we not the best of precedents for this action in our own government? In any question affecting any of the forty-eight states of the union, such as an attack by an enemy, does any one believe for a moment that the forty-eight states could defend their common interests as efficiently as the United States could?
6. The consolidation of the society's library with that of the United Engineering Society (which now contains over 55,000 volumes) will create the greatest technical library in the world.
7. In joining with the other societies in the ownership of this very excellent modern building, the society preserves its own individuality, prestige and seniority, whilst securing the above advantages.

Standardization of Buildings to Insure Economy and Quick Delivery

H. S. Jacoby Describes Method of Firm of Industrial Engineers Who Claim to Be Able to Make 30-Day Deliveries of Standard Buildings

STANDARD SIZES and standardized details for factory buildings were claimed to make possible not only decreased cost and increased profit, but rapid fabrication and 30-day delivery of the completed structures, in an address made by H. S. Jacoby of the Samuel Austin & Son Company before the students at Cornell University on Feb. 25. How this standardization is accomplished and the reasons for the selected standard dimensions are described in the following abstracts of Mr. Jacoby's address:

STANDARD 1—FULL PANEL OF STEEL SASH GIVES MAXIMUM LIGHT

DETERMINING REQUIREMENTS

In devising a method to get a larger margin between the actual cost and the selling price, or, in other words, a larger profit, the Samuel Austin & Son Company, industrial engineers, of Cleveland, decided to standardize building construction. This company believes that the time is coming, and coming soon, when a prospective owner will sacrifice some of his "pet" ideas if he knows that he can get a building which will answer his purpose and get it within 30 days after the signing of the contract. To this end designs and complete details for seven standard buildings have been drawn up. Furthermore, the fabricated steelwork and other items which are not under direct control are even put into stock. It requires faith, coupled with an optimistic and powerful sales manager, Mr. Jacoby asserted, to have on hand three buildings 100 x 400 ft., two buildings 90 x 300 ft., and one building 200 ft. square before any actual contracts are in sight.

It has taken years of study to arrive at the general dimensions and outlines of buildings which will meet the requirements of a large proportion of manufacturers, engineers and prospective owners. Often the width of the building is determined by the room permitted by adjacent structures or the size of lot available. But, having adopted a certain unit width, say 100 ft., consisting of two 50-ft. aisles, there is a great advantage in being able to increase the width by further additions of 50-ft. aisles.

SEVEN STANDARD BUILDINGS

Standard 1 is a simple steel I-beam structure of one story, with 14 ft. clear height and 60 ft. width out to out, and one intermediate row of columns. Standard 2 is a heavy machine shop or foundry building 90 ft. wide, with three 30-ft. aisles and a traveling crane in the center aisle, with 22 ft. 6 in. clear height to the I-beam rafters. Standard 3 is a 100-ft. one-story factory building, with central monitor and a steel roof truss of the Warren type supporting the flat-slope composition or tar gravel roofing. This is a popular type and contains but one row of intermediate columns. The clear height of 13 ft. under trusses is ample to allow for most requirements. Hundreds of these 50-ft. roof trusses are carried in stock; the columns are not cut to exact length, but are kept in stock ready to cut on very short notice.

Standard 4 is a saw-tooth-roof factory building. The columns are spaced 20 ft. apart in both directions, making all trusses exactly alike, and the vertical faces are used for the roof sash to give rigidity, and because less expensive side-wall sash can be used. Standard 5 is a typical forge shop or structural warehouse for use where a heated building is not required. It has sloping corrugated-iron roofing and is 100 ft. wide, with central aisle 40 ft. wide and 34 ft. high for the crane runway.

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STANDARD 3—NEW CASTLE CONSTRUCTION COMPANY FACTORY BUILDING

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STANDARD 6—FRANTZ-PREMIER BUILDING IN CLEVELAND

Standard 6 is a multi-story mill building with upper tier similar to standard 1, steel frame and brick walls below the steel sash windows. For this type 16-ft. bays are specified. Since the same load is carried by the floorbeam of this type on a 20-ft. span as by the roof beams of types 1 and 2 on a 30-ft. span, standard 18-in., 55-lb. I-beams are kept in stock and cut into three parts for the floorbeams in type 6, or two parts for the rafters in type 1 or 2. Standard 7 is a strictly fire-resistive type of multi-story reinforced-concrete building with round columns, flat-slab floors and the regular brick and steel sash walls.

The height of a building is determined by a combination of requirements. Viewed from the outside, a certain sill height is necessary, and above this sill sufficient glass to insure good illumination. The sill height may be determined by the height of work benches, the storage of materials or the height of pipe coils for heating purposes. An over-abundance of sash means unnecessary expense for heating. Viewed from the inside, the clear headroom varies with the depth of the supporting steelwork, the height of the machinery in the building, the presence of traveling cranes or other special apparatus.

STANDARD SIZES—20-FOOT BAYS

In the design of standard buildings capable of being erected in thirty working days, commercial and standard sizes of materials must be strictly adhered to. The structural steel man passing through the drafting rooms of our colleges and noting the sample drawings on the walls will almost invariably detect timber or steel sections which are uneconomical or not in general use, and consequently hard to obtain. For instance, a 2½ x 2½ x ½-in. angle may be designated in a roof truss. A 4 x 3 x 5/16-in. angle is stronger, weighs less, costs less per pound and is kept in stock by every steel company.

Why did we adopt the bay length of 20 ft.? First of all, there is a great advantage in the use of whole numbers rather than fractions. Why choose 20 ft. when 20-ft. lumber costs more per thousand than 16 or 18-ft. lumber? Simply because a 6 x 12-in. roof purlin, far cheaper than a steel beam with a nailing strip bolted to the top flange, is stressed to its maximum capacity when supporting a panel roof load 8 ft. wide and 20 ft. long. Eight feet is the maximum spacing of roof purlins for 2-in. roof sheathing. These yellow-pine boards are dressed and matched from 2 x 6-in. lumber. To prevent deflection a continuous 2 x 6-in. flat is nailed to the under side of the roof sheathing midway between the purlins.

One more factor, the steel sash, entered into the 20-ft. spacing of roof trusses. We examined the catalogs of various sash manufacturers to get a combination of units which total exactly 16, 18 or 20 ft. The two sizes of glass in most general use are 12 x 18 in. and 14 x 20 in. Of these two the 14 x 20-in. size is the more economical. Four units of four lights each are placed from column to column, and the ends measure exactly 20 ft.

There are many advantages in having the steel sash line up at the columns with the structural steelwork. During erection sash has a tendency to creep. In a 400-ft. building the actual out-to-out dimension of sash may exceed the computed dimension by 6 in. When the units line up with some definite mark, as they now do with the columns every 20 ft., the variation of actual from theoretical dimensions is reduced to a minimum.

STANDARD STRUCTURAL DETAILS

The principal feature of our standard truss is that the details are arranged to permit all trusses to be exactly alike. The wind load is taken by a system of bracing in the plane of the upper chord. Open holes in the rafter angles engage the lateral plates for the connection of diagonal rods. The equal spacing of these plates means equal length of rods. The cost of shop work is reduced, likewise the cost of drawing. Erection is simplified, as the erector can pick up any truss and place it between any two columns.

All clip angles which engage the wood purlins are identical. On the main truss there is no evidence of the presence of a monitor truss. In reality the vertical members of the 34-ft. monitor are connected to angles similar to those used for purlin clips. This arrangement permits the use of the standard truss with or without the center monitor. A star strut composed of two steel angles extends continuously between the tops of all center columns.

STEEL SASH ECONOMICAL

When any considerable area of windows is required, wood sash is seldom considered in mill-building construction. Steel sash costs less, is non-combustible, lasts longer and offers a greater unobstructed lighting surface on account of the thin muntin bars. The present tendency is to give the factory plenty of light, the direct rays of the sun being subdued by ribbed glass, which also keeps the attention of the employees directed to the inside of the building. To-day it is cheaper to erect steel sash than to fill the same area with a brick wall. By a special arrangement with manufacturers, steel sash may be shipped to the job ten days after the order is taken.

EXCESSIVE SHIPPING SIZES

Needless delay and expense are often caused on account of excessive height and length of completed trusses. Even if a member more than 10 ft. high is accepted by a railroad at the shipping point, it is necessary to route the cars to avoid tunnels or bridges where the head room is not ample. For members more than 40 ft. long an idler is necessary, and it is almost impossible to load economically. To ship too much material loose for field riveting is of course more expensive than shop work.

In conclusion, said Mr. Jacoby, the near future offers a good opportunity to the young graduate who is thoroughly in touch with the building problem. At the present time many owners have tucked away in their office desks blueprints showing plans of proposed extensions to their plant. Europe is looking to this country to supply her demand, which cannot be supplied by the normal capacity of the American factories. With this demand will come the necessity of engineers with sound working knowledge and an unusual amount of common sense.

BEAR TRAP WEIRS CONTAIN ALMOST HALF OF CONCRETE YARDAGE, EXCLUSIVE OF THE LOCK

Two Ohio River Dams Built in Two Seasons

Locomotive Cranes on Trestles Handle Lock Work, While Floating Mixing Plants Were Large Factors in Progress on Dams and Guide Walls

THE UNUSUAL feat of completing a Government lock and dam on the Ohio River in two working seasons has been accomplished by one contractor with two dams, Nos. 16 and 17, which are 5 and 25 miles, respectively, above Marietta, Ohio. The contracts for these dams were let in the fall of 1913, and all work on both of them, including the removal of the contractor's plant, was completed by Jan. 1, 1916. Out of the twenty-six dams on which the concrete work has been finished, it is believed that only one other—dam 10, at Steubenville, Ohio—has been finished in less than three full seasons. The treacherous nature of the Ohio and its extraordinary range of 60 ft. or more between high and low water cause frequent flooding of the cofferdams and make imperative a construction layout that can cover a whole coffer so as to develop the work at maximum speed from the moment the water is pumped out. It also puts on the timing of the work and the advance construction of the several cofferdams a cash premium far in excess of that placed on these factors in other river work.

On these dams, locomotive cranes and traveler derricks on trestles were selected to do most of the hoisting work. The tracks were built while the cofferdams were being unwatered and the pump-boat foundations prepared. They were constructed, for the locks, out of piles and stringers used in the second season for the foundations of the guide walls. The concrete plants were designed so that the bulk of the yardage was spouted without tying up or hampering the excavating and hoisting equipment. For the locks, all but the gate foundations and a relatively small yardage in the upper part of the walls was spouted direct from side dump cars. For the rest of the work mixer boats, one of which was described in the Engineering Record of Oct. 30, 1915, page 552, were used. Plenty of floating plant and ample pumping capacity were provided. Sub-cofferdams were used, greatly reducing the quantity of general excavation needed for the rock foundations for the main sections of the work.

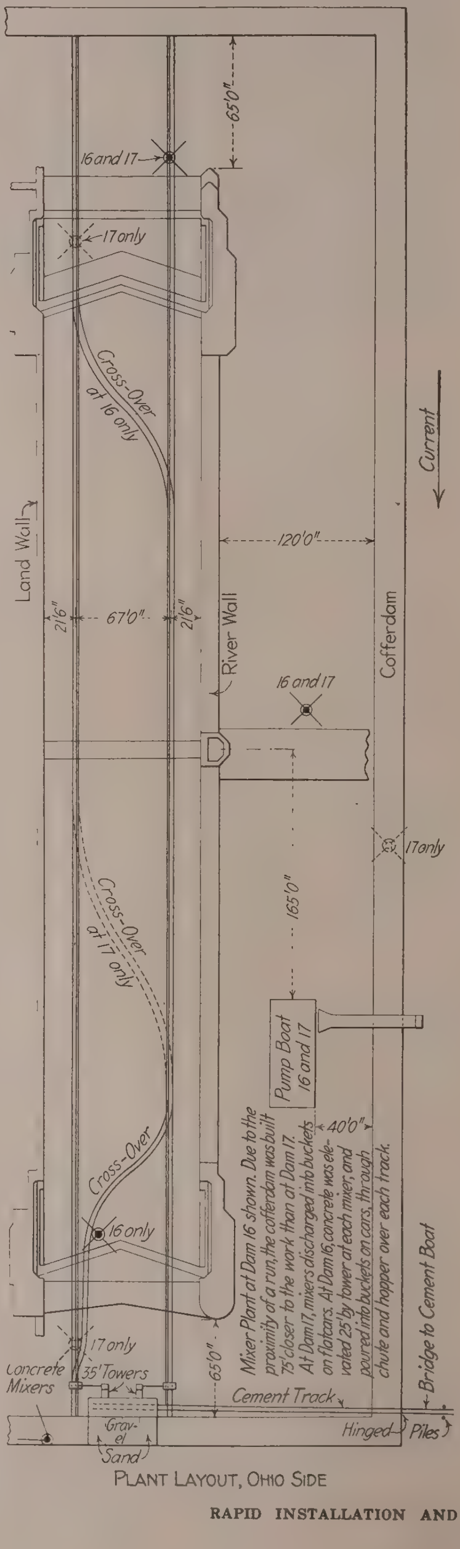
Status of Ohio River Development

The purpose of the fifty-four locks and dams being constructed from Pittsburgh to Cairo under the Pittsburgh, Wheeling, Cincinnati and Louisville district offices of the Corps of Engineers, U. S. A., is to maintain a navigable stage in the river during the nine months from April to January, when the river is normally below a 9-ft. stage. The design and operation of these dams, and some of the construction methods employed in building them, have been described in the issues of the Engineering Record of March 11, 1905, page 299; Dec. 26, 1908, page 712, and Jan. 2, 9, 16 and 23, 1909, pages 13, 41, 69 and 97; April 12, 1913, page 412, and Feb. 7, 1914, page 164. Twenty of these dams are in operation; the first contract, which includes everything except lock gates, wickets and operating machinery, has been completed on six others, and eight more are now under construction, while the remaining twenty have not yet been authorized by Congress. All but two of those completed and four of those under construction were let to contractors. These six were undertaken by Government forces under the day-labor plan. When the dams now being built are in operation the river will be navigable during the summer from dam 20, about 30 miles below Parkersburg, W. Va., to Pittsburgh.

Floods Make Work Difficult

The average period during which work can be carried on in the river extends from the middle of spring until Thanksgiving, and generally the work is flooded from one to four times in this period. In several cases within the last ten years the cofferdams have been flooded as often as once a month, and only two of these years have been free of floods in the working season. The loss of time caused by a flood varies from about ten days, when the cofferdam and permanent work escape damage, to a month or more when damage is sustained.

Contracts for these dams were let in August, 1913, four years being allowed for their completion. Camps had to be built, as there were no large towns near either dam, and all labor had to be brought in. Work on them and on the construction yards was begun as soon as possible and practically completed that fall. The layout of the yard at dam 16 is shown in the accompanying drawing. That at dam 17 was similar, but had to be located a mile upstream from the work because of the contour of the ground. The main yard sidings at each dam extended out into the river about 100 ft. on pile trestles. From these all materials and supplies except coal were handled by a locomotive crane direct from cars and storage to flats. Coal was dumped



Mixer Plant at Dam 16 shown. Due to the proximity of a run, the cofferdam was built 75' closer to the work than at Dam 17. At Dam 17, mixers discharged into buckets on flatcars. At Dam 16, concrete was elevated 25' by tower at each mixer, and poured into buckets on cars, through chute and hopper over each track.

PLANT LAYOUT, OHIO SIDE

RAPID INSTALLATION AND

from cars into bins built in the trestles, and from the bins into flats. Practically all of the coal was brought in by rail, as very little could be transported by river on account of low water, which continued during most of the construction period.

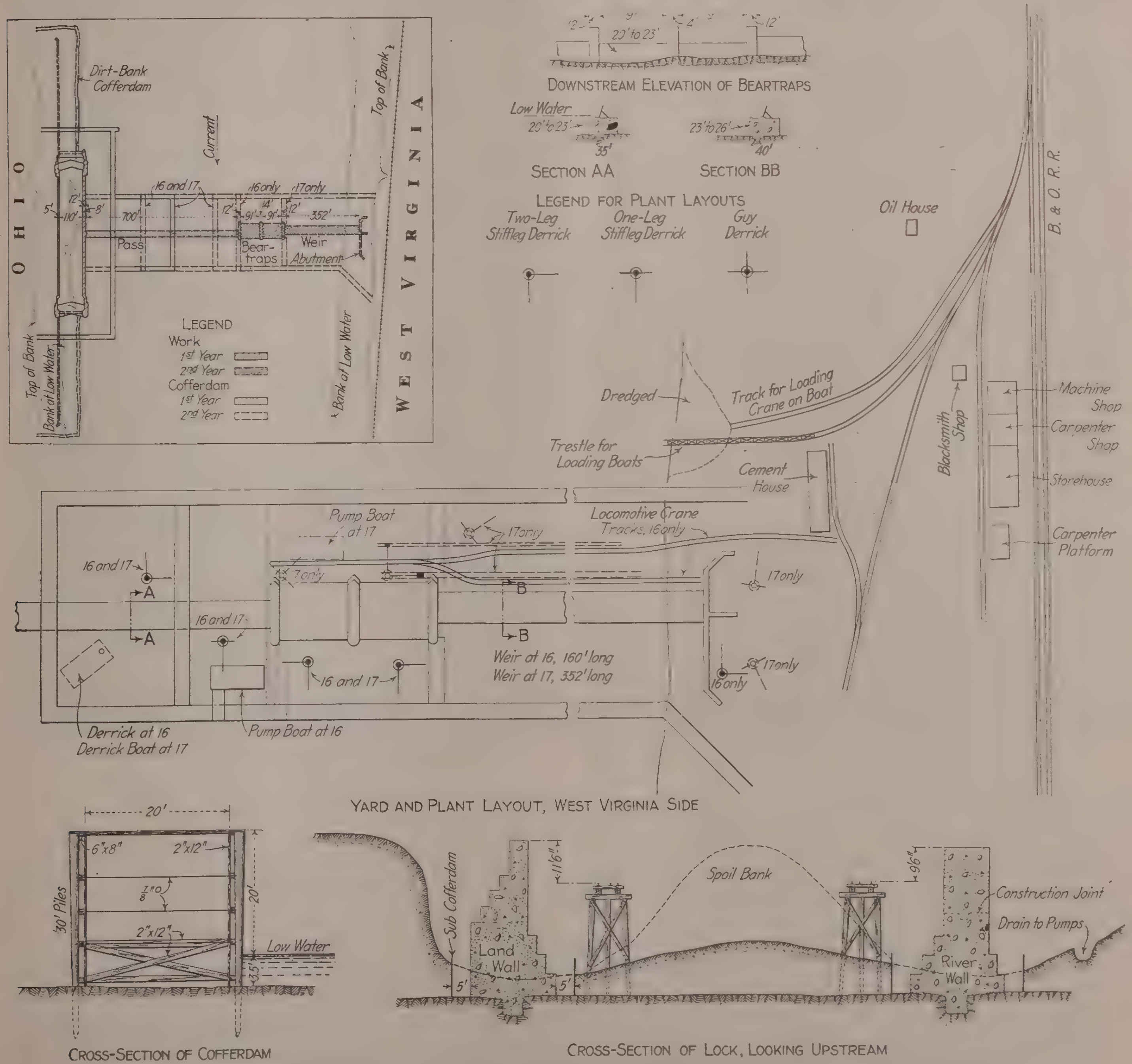
The first work on the dams done at each site was to build the cofferdams and dredge the sites for the two locks. Three-fourths of the cofferdam for the lock at dam 16 was finished and about one-half of the common excavation in the lock at each dam was completed in what remained of the 1913 working season. All the material possible was removed from the site of the permanent work and used for filling and banking the cofferdams. Though there was a large quantity of this excavation it was necessary to dredge from the river about 50 per cent of the material required for the banking and filling. The cofferdams were of the box type, 20 ft. wide and from 16 to 20 ft. above low water. The total height above the river bed ranged from 20 to 35 ft., the latter height being caused by scouring of the river bed, which took place after the channel had been restricted by previous cofferdams. Only those coffers maintained during the winter were decked.

LOCK EXCAVATION STORED BETWEEN CRANE TRACKS

While an effort was made to remove all the material possible before closing the coffers, it was found on unwatering that usually from 5 to 8 ft. of material remained over the rock. To handle this out of the cofferdam would have been expensive. As the lock floors were not to be paved at either dam, the space inside the lock walls offered an economical place for dumping. In order to take advantage of this space, however, elevated tracks for the hoisting apparatus were a necessity. Locomotive cranes on trestles slightly below the top of the walls were employed. Besides being easy to install, these tracks enabled the cranes, with their relatively short booms, to cover the foundations of the walls, reach the top of the high spoil bank required, handle all forms and pass concrete buckets to the top of the wall forms. None of these things could have been accomplished with cranes at the level of the first excavation. Because of the difficulty referred to of wasting the sub-cofferdam excavation, and the depth to rock, it was out of the question to install travelers or other plant at the level of the lock floor. The crane trestles also provided a ready support for the concrete car tracks. The trestles were made of piles, caps and stringers which met specifications for the guide-wall foundations.

LOCK CONCRETE PLANTS

Concrete for the lock walls and gate and poiree dam foundations was mixed in two 1-yd. mixers at each lock. These were mounted at the lower ends of the cofferdams under bins fed by two derricks from barges. These derricks were also used to pass forms and plant into the cofferdams. Cement was brought across the river from the railroad on the West Virginia bank in covered boats. It was ordered so that the deliveries would cover the work being done as closely as possible to save storing and rehandling. However, 4000 bbl. storage capacity was pro-



ABILITY TO DEVELOP WORK IN AREAS UNWATERED AT GREATEST POSSIBLE SPEED WERE VITAL CONSIDERATIONS IN PLANT LAYOUT vided at each dam. The boats were loaded by chutes direct from the cars or from storage. Each had a center track which matched with a movable bridge connecting with a track inside the lower arm of the cofferdams. Flat cars on these tracks, hauled by a hoisting engine, were used to transport the cement to the mixers. These mixers discharged into narrow-gage side-dump cars which were hauled by dinkies on the crane trestles. These cars dumped into wide, metal-lined wood chutes supported on the trestle and the form. With them all the lower part of the lock walls was poured. For the upper sections concrete buckets hauled on flat cars were used. They were dumped by the cranes into hoppers on top of the forms. The work on the gate foundations was largely handled by the guy derricks shown on the accompanying layout drawings.

During the first season half of the navigable pass next to each lock was inclosed in a cofferdam and completed except for a portion of the concrete work. The only thing remaining to be done on the two locks at the end of the 1914 season was the installation of the permanent pipe lines.

DERRICKS FOR WEIR AND BEAR TRAPS

While this work was being completed the site of the channoine weir and bear-trap weirs at each dam was being dredged out and inclosed in a single cofferdam. This left a navigable channel 300 ft. wide, which the contract provided should be maintained at all times. The construction of these sections offered a totally different problem from the locks. The bulk of the concrete work for these dams is in the lock. Here the ratio of concrete to foundation and form work is highest, while in the rest of the work the ratio of concrete to preparatory work is very low. The problem in the lock is to pour concrete rapidly, while on the rest of the work the job is almost done when the forms are ready for concrete. The length of the bear-trap piers made cranes impracticable for the bulk of the hoisting work in these coffers, because of the reach required. One crane was used, however, at dam 16, but only to handle forms and the like into the coffer from the bank. The stationary and traveler derricks shown on the layout plans were employed for all other hoisting at both dams. As all the concrete could be most economically poured by mixer boats, it was unnecessary to provide any tracks or plant inside the coffers for handling concrete. At dam 17 the weir, bear traps and abutment were completed and the bear-trap leaves erected in this cofferdam. Short arms were then built to the ends of the east bear-trap pier, the east arm and the portion of the cofferdam west of this pier were torn out, and the channel over the completed channoine weir thrown open to navigation. Meanwhile the river arm of the lock cofferdam and the east part of the coffer inclosing the first section of the pass were removed. The second section of the pass was then inclosed in a coffer extending from the end of the completed section to the bear traps. The same procedure was followed as in dam 16, except that the second section of the pass was completed before the bear-trap cofferdam was constructed. Thus the final coffer at this dam inclosed the bear traps, weir and abutment.

The guide-wall cofferdams were earth banks made by dredging the site of the walls and dumping the dirt on the river side. These walls are on pile foundaions, about 7 ft. below low water. The piles were driven at the beginning of the second season with ordinary land drivers. The forms for these monoliths were handled by the locomotive cranes running on tracks supported on the coffer banks. The concrete was poured by the mixer boats.

MOBILITY OF MIXER BOATS

By carrying on the guide walls, abutment, pass, bear traps and weir at each dam simultaneously, and by using mixer boats for all concreting, the disadvantage of having a mixer plant idle half the time because there was no place to concrete was largely overcome. It was possible to move the mixing plants from place to place as sections were prepared for concreting. The work of getting ready, which takes the greater part of the time on this type of construction, could thus be prosecuted at the same time in several scattered places, each of which could be finished up in turn by the one floating concrete plant. The mobility of these floating plants thus became an important factor, the main consideration proving to be the time required for dismantling and moving the chutes. One of the boats was provided with a steel cantilever boom suspended from an A-frame. For the guide walls and 50 per cent of the remaining work this boom reached the forms direct. For the balance of the work an additional 56-ft. trussed chute was rigged. Because of the rigid support of the boom, the long chute on this boat did not sag when passing concrete, and it was possible to use it on the flat slope of 4½:1 with good results. The entire plant could be moved and started to concreting in a new place in 45 min. or less. The other mixer boat was similar to that at dam 16, except that its 120 ft. of initial reach was secured by a section of plain chute suspended from a main A-frame and two smaller A-frames hinged to the main one. Additional chutes, when required, were supported by a cable from the large A-frame to anchorages in the cofferdams. About 2½ hours were required to move this boat. Both boats were of the same size and capacity, except that the one with the trussed boom mounted but one 1-yd. mixer, while the other boat had two. The bins on both were charged from barges by derrick boats, and cement was run upon each boat on cars from the cement boats.

SUB-COFFERDAM EXCAVATION WAS ECONOMICALLY STORED BETWEEN THE LOCK WALLS BY USING CRANES ON EASILY BUILT TRESTLES

15,000 YARDS RUN IN 31 DAYS

Concreting was not permitted on Sundays and holidays, and the capacity of the mixer on the boat at dam 16 was limited to 30 or 33 yd. per hour, while the actual capacity of the plant was good for from 45 to 48 yd. per hour. The maximum output under the imposed conditions was made between Sept. 16 and Oct. 15, 1915. During this time the boat averaged 26 yd. per hour, including moves and changes from one form to another. A total of 15,000 yd. was poured in this period, using three 8-hour crews. The average monthly output of this boat was about 12,000 yd. On one occasion the boom on a 4:1 slope and the 56-ft. extension chute on a 6:1 slope worked without a single clog or spill. At this time concrete was being placed in the top of the lower end of one of the bear-trap piers with the boat stationed above the cofferdam.

CONCRETE MATERIAL FROM RIVER BED

The sand and gravel were dredged from the river bed with sand dredges of the side-bucket and ladder type with a capacity in 8 hours of material sufficient for about 300 yd. of concrete, using a 1:3:5½ mixture. The storage capacity of sand and gravel on this class of work depends somewhat on the number of flats in use, but mainly on the capacity of the sand dredge. This is determined largely by the sand and gravel deposits, the proportion of sand to gravel and the quantity of each wherever the dredge happens to be working. It often occurred that it was necessary to spend considerable time moving the dredge from place to place in search of material that would pass inspection and at the same time afford digging within two or three miles of the work at 50 to 75 per cent of capacity.

DRAINAGE PROBLEM INSIDE COFFERDAMS

A keyway varying from 3 x 3 ft. to 6 x 6 ft. was channeled in the rock for all walls and foundations subject to horizontal thrusts. This was accomplished with ordinary quarry bars and air drills run from compressors driven by steam. Natural gas was used for fuel. For the second season's work on the West Virginia side of the river the air was conveyed through one of the permanent 4-in. pipe lines embedded in the foundation of the pass.

An important obstacle to overcome was the freeing of the foundations of water so that they could be prepared for concrete. It was natural for the water to drain to these places, as they were the lowest points in the cofferdam except the pump sumps. With this difficulty in view the cofferdams were built at a distance from the work so as to leave plenty of room to drain the seepage near the bottoms of the cofferdams direct to the main pumping plant before it had a chance to reach the lower levels. The seepage through the river bed and on the rock surface, which always carried a quantity of sand and gravel, was kept off the working areas by the use of short steel piles, sand bags, wooden cribs and wood sheeting. This work for holding the water back from the foundations, known as the sub-cofferdam, had of course to be done before preparing the foundations. These had to be entirely free of water before concrete could be placed. Without these sub-cofferdams it would have been necessary to remove four or five times the amount of sand and gravel, and would have made progress slow and costly.

The seepage through the sub-cofferdams was pumped into the drains leading to the main pumping plant by siphons, 3-in. and 4-in. force pumps, and at times 6-in. centrifugal pumps, depending on the amount of water to be handled. The keyways afforded sumps for these auxiliary pumps.

The main pumping plant at each dam consisted of centrifugal pumps, auxiliary equipment and boilers installed on a boat. Natural-gas fuel was used. The electric generating plant for lighting the work was also placed on these boats. The capacity of each boat was about 16,000 gal. per minute, and at times it was necessary to set up additional pumps to assist, especially at dam 17. Here the seepage through the river bed and on the surface of the rock in the pass and weir coffers was very great, and for a river stage of 8 ft. and over required an average pumping capacity of about 20,000 gal. per minute, as compared with about 12,000 gal. per minute at dam 16 for the same work. The boats rested on pile foundations inside of the various cofferdams varying from 7½ to 12 ft. below low water.

ONE DREDGE FOR BOTH DAMS

Because of the nearness of the two contracts it was possible to make expensive items of equipment do service on both jobs. Only one dipper dredge, of 3½ cu. yd. capacity, was required for the preliminary excavation on both dams. Two 100-yd. scows were used with it. A sand dredge and a steamboat were used at each dam. Six derrick boats, two gasoline tow-boats, four launches for ferrying, the pump boats, two boiler boats, sixteen sand and gravel flats, six fuel flats, six decked scows, four cement boats and the mixer boats completed the fleet used on the two contracts. Four locomotive cranes, two concrete mixers, six derricks, five 6 to 12-in. centrifugal pumps besides those on the pump boats, dinkey engines and a supply of flat cars, hoists and buckets were required at each dam. Exclusive of the derrick boats, dredge and steamboats, each job required the installation of 1000 boiler hp. Natural gas was used largely for fuel, and was used entirely in the construction camps.

LEAKS THROUGH RIVER BED UNDER COFFER ARE SERIOUS PROBLEM—THIS DAM MADE 20,000 GALLONS A MINUTE AT 8-FOOT RIVER STAGE

These dams were built by the T. A. Gillespie Company under the direction of the U. S. District Engineer Office at Wheeling, of which Maj. F. W. Alstaetter. Lieut.-Col. Henry Jervey and Maj. Thomas Jackson were successively in charge. E. A. Yates is chief engineer of the contracting firm and H. B. Mish resident engineer. Thomas S. Shepperd, vice-president in charge of the Pittsburgh office, has had general direction of the work. R. J. Gillespie is general superintendent for the contractor, N. J. Beisel was superintendent at dam 16 and R. M. Netherland at dam 17, while C. R. Andrew, junior engineer, and Ormond Butler were in charge at the respective dams for the government.

AN AUTO ROAD TO THE SUMMIT OF MT. SHASTA in California is planned by the U. S. Forest Service in the development of the Shasta national forest. Funds have been set aside by the Forest Service, it is reported, for a preliminary survey of the proposed route of this road and for an examination of the region it will traverse. Certain areas of the mountain which are considered suitable for summer homes, permanent camps and resort sites are to be surveyed and offered for lease by the government.

Road Builders Hear How New York State Department Paves with Brick

H. E. Breed, First Deputy Commissioner, Recites Experiences in Construction Details and Gives Costs at Pittsburgh Meeting

AS A RESULT of its experience in building about 300 miles of brick pavement prior to Jan. 1, 1916, the New York State Highway Department has selected certain construction features as basic in the success of this type of work. These were discussed at the Pittsburgh convention of the American Road-Builders' Association last week by H. E. Breed, first deputy commissioner, whose remarks are summarized below. Mr. Breed laid stress on the mixing of grout, the proper selection of sand and favored field instead of plant sampling and testing of brick. He also presented figures on first cost and maintenance.

CONSTRUCTION DETAILS

It has been claimed, Mr. Breed said, that the sand cushion prevents the crushing of the brick and gives an amount of resiliency that is necessary to a pavement of this type. This statement, however, is not borne out in practice, for a five-year-old pavement in which a mortar cushion was used has been bettered by the lack of so-called resiliency.

Many times brick are stored in piles along the road so long in advance of the construction work that they are so spattered with mud from passing traffic and so covered with dust that it is doubtful whether the grout will properly adhere to them. In all cases of this kind the brick should be thoroughly washed so that the grout will cement them together.

Bats less than 3 in. should not be used. If necessary, trim the second brick to accomplish this. The bats should be obtained from bricks culled from the pavement, and as every brick is worth from 3 to 4 cents in the pavement, the selection of bats should be made from culls so that the good half can be saved. This is an element of fairness to the manufacturers which all engineers will appreciate.

Great care should be given to the thorough mixing of the grout—sand, cement and water—first dry, then to a plastic consistency, and gradually thinned out until the mixture just reaches the consistency which will flow. In the New York State work the contractor is allowed to use 1 part of cement to 2 parts of sand where he employs some form of grout machine. Where he mixes by hand in boxes he is required to furnish grout with 1 part of cement to 1 part of sand.

SAND IMPORTANT

Many bad results in brick pavements have been directly attributed to the use of poor sands. The inconsistency of present day practice, according to Mr. Breed, is shown by testing the cement and brick both with a fine degree of engineering precision and trusting the other material, sand, to visual guesswork.

Three different and distinct kinds of sand are used in brick pavements: concrete sand, cushion sand and grout sand. Concrete sand should be clean and have at least 80 per cent of the strength of Ottawa sand in compression. Its gradation should be as follows: 100 per cent passing ¼ in.; 85 per cent passing No. 6 screen; 60 per cent passing No. 20; 25 per cent passing No. 50; no variation of over 5 per cent from these figures should be allowed. Sand with over 8 per cent of loam should be rejected. These may seem to be rigid specifications, but if a foundation is to serve its purpose it should be strong enough to sustain the pavement with the minimum amount of cracking.

Cushion sand should be of such a nature that 100 per cent will pass a No. 6 screen, and it should not contain more than 20 per cent of loam.

Grout sand should be clean and of such a nature that it will have 100 per cent passing a No. 6 screen; not more than 85 per cent passing a No. 20; 30 per cent passing a No. 50; 5 per cent passing a No. 100. It should be rejected if it contains more than 5 per cent of loam.

FIELD TESTS FAVORED

It has been suggested at various times, both by manufacturers and by some engineers, that it might be advisable to test brick at the plant. Mr. Breed believes that the present practice of sampling and testing brick in the field insures better results than testing at the plant, for the following reasons:

Brick are not manufactured uniformly in the same sense that cement or asphalts are manufactured as uniform products. Long experience with a given brand is necessary before the brick can be accurately culled by visual inspection. The men best fitted to cull brick by visual inspection are the employees of the brick company. The sampling from the different benches of the kiln to show the variations in burning can be done more accurately by the burner than by an inspector. Variations in temperature in different parts of the kiln give different qualities of brick. These can be assorted and selected best by the men who burn them. Factory inspection of brick places the responsibility of uniform shipments of acceptable brick on the inspector, and offers an opportunity to the brick company to dispose of cull brick, because of its lack of responsibility in the selection.

During 1915 the New York Highway Department tested 269 lots of brick, comprising 22 different brands and representing a total of 27,000,000 brick. Of these 13.6 per cent failed to meet the specifications and were rejected. This does not include the amount culled by the inspectors and rejected on the work, which, in some cases, is rather large. With brick tested at the plant, it is believed, the chances for getting good material would decrease, for if the manufacturers were willing to take such a long chance with a large outlay of freight and handling involved, they would certainly be willing to give inferior material at the plant and would load some brick from the kiln which would not be good enough to go into the work.

COSTS AND MAINTENANCE

Up to Jan. 1, 1916, New York State has completed about 290 miles of brick pavements. These different pavements are of varying age, and Mr. Breed gave some figures regarding their cost. The average cost for brick pavement on a 5-in. concrete foundation is per mile of 16 to 26-ft. highway $25,750. The average cost per square yard of *pavement only* is $2.015. These figures were obtained from an average of 23 highways.

In order to get a comprehensive cost of other types in New York State, the following figures on waterbound macadam, bituminous macadam and cement concrete were presented:

Waterbound macadam:	
Cost per mile of 16-26 ft. highway	$10,250
Cost per sq. yd. of pavement only	0.648
The cost per square yard was obtained from 434 values and the cost per mile from 419 values.	
Bituminous macadam:	
Cost per mile of 16-26 ft. highway	$12,970
Cost per sq. yd. of pavement only	0.871
Both of these items were obtained from the average of 134 highways.	
Cement concrete, 6 in. thick:	
Cost per mile of 16-26 ft. highway	$15,320
Cost per sq. yd. of pavement only	1.121
Both of these items were obtained from an average of 20 highways.	

It will be noted that the difference between the pavement cost and the total cost of the highway lies, in all cases except brick, between $4,000 and $5,000. The reason why the cost of items other than pavement is apparently high on brick roads is that the cost of edging has been excluded from the pavement cost and included in the total cost.

Up to Jan. 1, 1915, there have been built in the state of New York 5,167.19 miles of all kinds of highways. During 1915 the department built 1,083.35 miles, making a total of 6,250.54 miles of road. At the present time there are 783.05 miles under contract which are not completed.

RELATIVE MAINTENANCE COST OF THE WHOLE ROADWAY

The maintenance charge for 238 miles of brick for the year 1915 was $41,840, or approximately $176 per mile per year. This amount was increased to a large extent by a number of older pavements which had many replacements. Eliminating those, there were 107.91 miles of brick pavement which cost $14,185 to maintain and repair. This is at the cost of approximately $131 per mile. These figures, as mentioned at first, are not the figures from the pavement alone, and they include such treatment as cleaning ditches, cost of patrol where patrol was needed, fixing the shoulders which are cut up by the turning out of traffic, the cleaning of slides and maintaining of guard rail. From observation it would be safe to say that about 30 to 40 per cent of this cost is the average cost that would cover the maintenance of the pavement alone, although in some cases, for a series of years, there is practically no cost to the pavement proper.

The cost of maintenance of other types of pavement during the same year was computed on the same basis as that for the brick roads, i.e., including the maintenance of guard rail, shoulders, ditches, patrol, etc., as well as the surfacing. For gravel it cost $577 per mile for 192 miles of road; for waterbound macadam it cost $564 per mile for 2298 miles of road; for penetration method bituminous macadam it cost $448 per mile for 2387 miles of road; for bituminous macadam mixed method it cost $181 per mile for 63 miles of road. For second-class concrete roads requiring surface treatment it cost $532 per mile for 295 miles of road; for cement concrete pavement 1:1½:3 mix it cost $129 per mile for 84 miles of road.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Locomotive Runs Three Hours on Charge From Boiler Plant

A FIRELESS steam locomotive is used for switching cars and tie trams at the Orrville (Ohio) creosoting plant, described by E. A. Sterling in the Engineering Record of Feb. 26, page 283. The locomotive is of a type which was developed in Europe some years ago and is used around distillation plants, where cinders and live ashes would constitute a fire danger. This locomotive operates by steam, the boiler being charged about seven times every twenty-four hours at the main boiler, at 150 lb. pressure. The maintenance cost of this type of switching engine is very low, and its use is said to be very satisfactory in a treating-plant yard. Its tractive power is fully equal to that of the usual type, and although it weighs only 22 tons it has pulled as many as twelve loaded gondola cars at a time. Perhaps there are construction contracts on which a locomotive of this type would be an economy.

TWELVE LOADED RAILWAY CARS AT A TIME HANDLED BY THIS FIRELESS LOCOMOTIVE

Good Form Design Saves in Labor and Lumber on Building Work

FORM designs should be arranged to reduce the number of special panels and pieces, should take into account the total quantity required, considering the movement of the forms throughout the job, and should furnish an accurate key to the quantity and size of stock required and to the order in which the component parts should be made, according to a paper presented at the twelfth annual convention of the American Concrete Institute at Chicago by R. A. Sherwin of the engineering force of the Aberthaw Construction Company.

Such a design requires a careful study of the building plans, with a view to having modified such details as would make the form work unnecessarily expensive, and the immediate preparation of a progress chart. The latter is usually determined by the time allowed for completing the building. As soon as it has been prepared, the quantity of forms and the order in which they are to be erected and moved can be determined. This chart also shows when the form design must be ready to allow sufficient time for making up and erection.

A conference is then held between the man in charge of form design and the field men, at which the sizes and kind of lumber that will be cheapest and that can be delivered on time are determined. The point at which work must begin and the location, type and capacity of the concrete plant must also be settled. The general scheme of the form work should be outlined at this conference with the field men to make sure that the design is understood and acceptable to them. If this is the case, they can carry it out much more readily.

The first study and drawings are made from a general assembly, which is selected from different combinations as the most economical for the conditions. Joists and girts should be in as few lengths as possible. Stock sizes of lumber should be used. The number of different panels and pieces should be kept to a minimum. Panels should be a whole number of boards in width, and joists should be used as panel cleats where possible. Units should be as large as can be handled, and detailed so they can be reused. Bracing should be above the men's heads, and provision should be made for easy stripping and for reshoring if necessary.

After the general assembly is made, sheets are detailed for each panel, ten panel details going on a standard-sized sheet. Each detail is marked according to a standard system of symbols. Blueprints from these sheets can be cut apart and used by the carpenters making up the panels. A key plan showing the complete assembly with the location of all the panels is also prepared. This is made very complete, as it is the only plan referred to in assembling the forms. It has been found best to use large lettering and furnish photo-reduced copies to the job, as they are much easier for the foremen to handle and refer to. As a rule, one such plan is made for each floor.

An important point to be remembered in proportioning the form members is that the posts cannot be stressed above the crushing strength of the girts which rest on them. The girts are stressed across the grain, which gives a much lower allowable load for each post, spaces them closer together and reduces the danger of deflection and settlement while the floor is being poured.

Boom Mixing Plant Big Enough to Build Concrete Houses

By R. C. HARDMAN
Colorado Springs, Col.

A NOVEL type of concrete plant used a few years ago in the construction of a group of reinforced-concrete buildings forming Fort Crockett, a coast artillery post at Galveston, Tex., resembles the ordinary boom mixer in operation, but not in size. The plant was designed in order to avoid the necessity of chuting and at the same time to provide an economical means of placing concrete in separate buildings, most of which were in a row about 2200 ft. long. This made it imperative that the plant be of a portable type. The type of building construction was such that the yardage of concrete was relatively small. A plant with tower and chutes mounted on a flat car was first planned, but the idea was discarded because of the great expense and delay incident to moving chutes when pouring the thin walls and floor slabs. The plant decided on is shown in the accompanying photograph constructing a building of the Aiken flat-wall type. The walls were hollow and 9 in. in total thickness. The height of the walls standing in the photograph is 31 ft.

The mast and the two stifflegs are carried by a triangular base mounted upon four-wheel trucks, the wheels having very wide treads. Upon this triangular base is mounted a hoisting engine and a Smith mixer having a capacity of a two-sack batch. On the opposite base of the triangle from the mixer is located, in addition to the hoist, a boiler and a large tank containing crude oil for fuel. The cables operating the bucket and trolley pass from the drums on the hoist to the foot of the mast, thence up the mast and along the lower side of the boom. The line operating the trolley has its ends fastened to either side of the trolley and is continuous around the drum. The bucket cable has its ends fastened at the end of the boom and on the drum, the block suspending the bucket being in the bight of the line. It will be seen that by this arrangement it is possible to move the trolley along the boom without changing the height of the bucket.

In operating the plant the bucket, which is of the bottom dump type, is set on the ground at the foot of the mast and filled from the mixer drum through a short chute. The bucket is then hoisted up the mast to a height sufficient to clear any form or other obstruction. The bucket is then run out on the boom and dumped. Some care is required on the part of the hoist runner to avoid swinging the bucket when it is started and stopped. This is especially true when the bucket is being used close to the ground.

The mast is pivoted at top and bottom so that it is free to move through an arc of about 270 deg. The boom is moved as desired and held in position by means of a tag line. The ends of this line are anchored on either side of the boom and the bight passes over single blocks on each side of the boom and hangs down between them nearly to the ground. This method of rigging the tag line makes it possible for one man to handle the boom easily, and by sitting in the bight to hold it in any desired position. The tag line requires the attention of one man anyway, as in pouring thin walls and floors the boom is constantly in motion.

The entire plant is moved by means of a set of falls attached to a dead-man and handled on the nigger-head of the hoist. As the ground on which the plant was used was soft, planks were used for the wheels. The plant has also been used for pile driving, a pair of leads containing a steam hammer being suspended from the trolley in the same manner as the bucket.

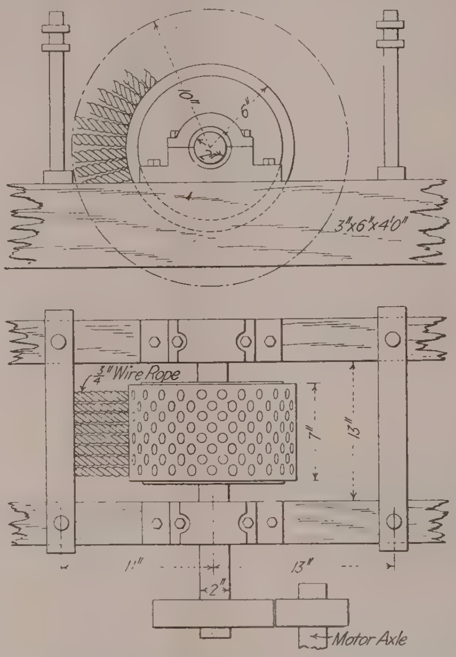
In placing concrete the capacity of the plant was dependent on the location of the forms as well as on the thickness of the wall or floor poured. Practically no time was lost in shifting the boom, as this could be done while either the bucket or trolley was in motion. In fact, the movement of the load in all three directions could be accomplished at the same time. On fairly open work, such as a 6-in. floor, as much as 150 yd. could be placed in 8 hours, while on thin-wall work about half this amount, or less, was possible. The ability of the engineman is an important factor.

The plant was designed by E. A. McGonigle of James A. McGonigle & Son of Leavenworth, Kan., who were the contractors for the work.

Brush of Old Wire Rope Run by Motor Cleans Reinforcing

By RICHARD R. BRADBURY
East Pleasantville, N. Y.

ON a large contract the steel for one of the smaller structures, which had been purchased a year or more before being used and stored on the job, was economically cleaned by a rotary wire rope brush made at the work. As there were over 90,000 pounds of deformed bars in this structure, cleaning by hand would have been a long and expensive process. The circular power brush shown in the accompanying drawing performed the cleaning in a very satisfactory and expeditious manner.



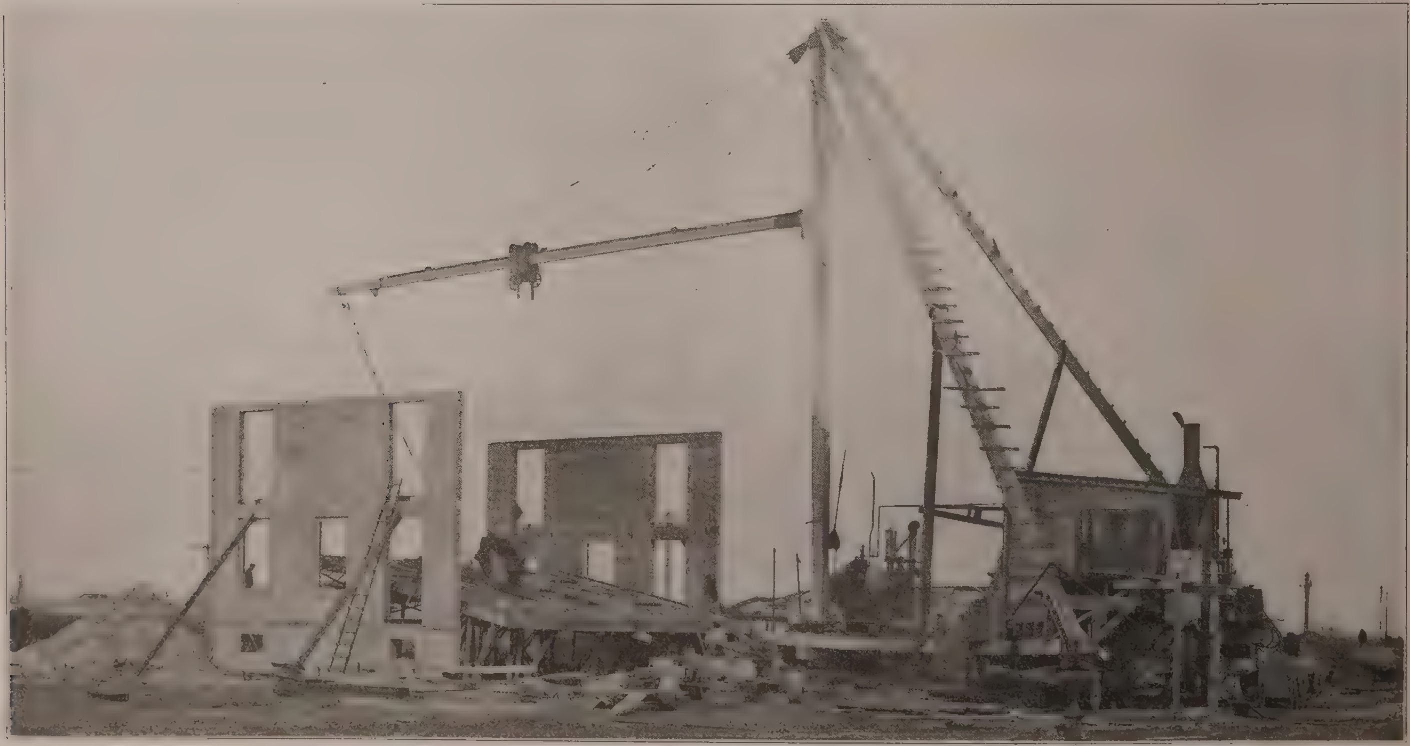
BRUSH CLEANS RODS RAPIDLY AND WELL

The brush consisted of an iron box formed by a ring enclosed on each side by a circular plate, the whole being keyed to an axle which was driven by a small electric motor. Short lengths of old wire rope projected through holes bored in the iron ring, the length projecting and the spacing being arranged so that the frayed rope ends made a stiff, close-set brush. The machine was mounted on a short wooden frame, at the two ends of which were erected guides to hold the steel bars against the brush.

The ring and plates forming the iron box were of ¾-in. metal, and ¾-in. wire rope was used, in pieces of such lengths that each end projected about 4 in. from the box. After the pieces were all in place the portions inside the box were cemented together to prevent slipping. The holes in the ring through which the rope ends projected were in eight rows, staggered, the rows being spaced evenly across the ring, and holes about 1½ in. apart in the rows. The whole machine was mounted on a frame of two 3 x 6-in. planks. The guides, which were mounted on the same timbers, consisted of two uprights of 1-in. round iron, threaded, each, one upright being attached to each timber. Two ½ x 2-in. iron plates about 18 in. long were bored to slip over these uprights. The plates were held at any desired height and spacing by nuts on the threaded uprights.

This machine, which was very successful, required two men to operate. It easily cleaned over 1000 ft. of rods in an hour. The cleaning was also much more thorough than hand cleaning.

WATER-SUPPLY SYSTEMS in 155 out of 204 cities of the United States which have a population exceeding 30,000 are owned by their respective municipalities, according to data recently compiled in San Francisco. The cost of treatment per million gallons covers the wide range from 4 cents in Chicago to $17.46 in Columbus, Ohio, the report continues. In Chicago the chemical sterilizing process is used exclusively.



TRAVELING CONCRETE PLANT WITH LARGE-SCALE BOOM DISTRIBUTOR PLACED 70 TO 150 YARDS AN HOUR IN BUILDING ARMY POST

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Propose Another Code of Ethics for Engineers

Western Society of Engineers Presents for Discussion an Original Statement of Basic Principles

General principles of ethics, rather than a set of fixed rules universally applicable, are embodied in the code of professional conduct proposed by a committee of the Western Society of Engineers and on which general discussion is invited before adoption. The engineering profession, holds the committee, includes many classes and degrees of responsibility, many types of service and a great variety of relationships which will tend to require modification of any code except one in which only the most general principles are expressed. The best guide to correct detailed professional relations is considered to be a keen appreciation of the general professional status, and a conscientious attempt to be guided in each specific case by the spirit of the general ideas. Society discipline, though necessary in extreme cases, is to be deplored and avoided where possible, the loss of respect of one's profession being considered sufficient for the wilfully guilty.

The whole code closes with the following recapitulation:

"The ethical standards of the engineering profession should be those of a fraternity. The engineer should recognize that he is endowed by the profession and the state with specialized knowledge for peculiar, judicial and responsible public service, involving the life, safety, comfort and convenience of his own and coming generations, and that in response to these he should so conduct himself as to be appreciative of his indebtedness to his profession for his opportunity, and make return by every effort, by a life of special usefulness devoid of unseemly greed, and filled, if possible, with a multitude of those small courtesies, the practice of which encourages the spirit of forbearance and is helpfully conducive to the fine art of living well together."

Steel Company Plans to Spend $20,000,000 at Baltimore Plant

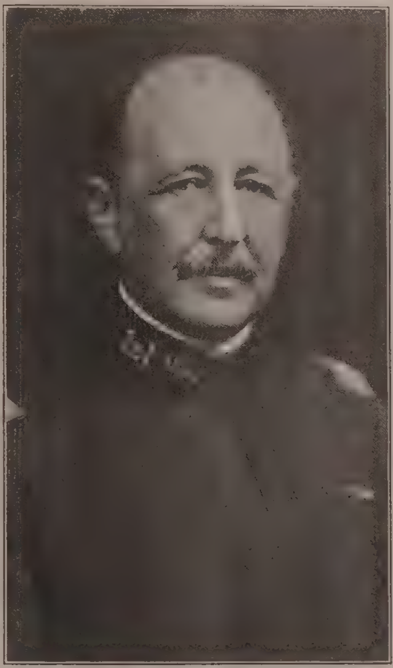
President E. G. Grace of the Bethlehem Company has announced that, while only tentative plans have as yet been prepared, the recently consolidated companies are planning to spend from $10,000,000 to $20,000,000 in improvements and additions to the steel making and ship building facilities of the Maryland Steel Company's plant at Sparrows Point, near Baltimore, Md. Recognizing the favorable conditions and location of this plant, it is possible that the present blast furnace capacity will be doubled, with a corresponding increase in the capacity of the open-hearth and Bessemer plants.

First Unit of Twin Peaks Tunnel Bore Completed

The first construction period on the Twin Peaks tunnel at San Francisco was completed Feb. 26 when headings being driven from opposite directions met between the western portal and the Laguna Honda station. Work has been in progress for nearly a year between these two points. Crews are also working from the eastern portal toward the first station at Eureka Valley. When this point is reached there will be no other outlets until the crews meet in the longest stretch of the tunnel under Twin Peaks proper.

Alabama Power Company to Place Order for New Plant

Recently Appointed Chief of Engineers, U. S. Army



BRIG.-GEN. W. M. BLACK

The Alabama Power Company will place an order, probably this week, for a 20,000-kw. steam power plant to be built on the Warrior River in Alabama, according to information received by the Engineering Record and confirmed by telephone by President Mitchell of the power company. The cost of the plant will be over $2,000,000. Plans are in preparation also for an additional unit at the hydroelectric station at Lock 12 on the Coosa River, which will add 20,000 hp. to its capacity and cost about $1,000,000.

To Replace Oakmont Bridge on Bessemer & Lake Erie Railroad

The Bessemer & Lake Erie Railroad officials announce that work will be started at once to replace the present bridge over the Allegheny River at Oakmont, near Pittsburgh, with a new structure, said to be the largest of its kind in America. The present bridge is inadequate for the heavier engines and car loads now used, and will be supplanted by a continuous truss 1800 ft. long and 170 ft. above the river. It is expected that the new structure will be completed in about 14 months.

H. P. Borden Appointed Member of Quebec Bridge Commission

By an order-in-council the Canadian government has appointed H. P. Borden, of Montreal, formerly assistant to the chief engineer of the commission, to succeed the late C. C. Schneider as member of the Quebec Bridge Commission. Mr. Borden's work on the new bridge, with which he has been connected since the appointment of the commission, is well known to many engineers.

Organizer of Cuban Public Works Department Becomes Chief of U. S. Engineers

Brig.-Gen. W. M. Black, Corps of Engineers, U. S. A., Succeeds Brig.-Gen. D. C. Kingman, Who Retired March 6

Brig.-Gen. W. M. Black, who organized the Department of Public Works of the Republic of Cuba during the American Occupation from 1899 to 1901, and brought it to a state of high efficiency during the Intervention from 1906 to 1909, has been appointed chief of engineers of the United States Army, succeeding Brig.-Gen. Dan C. Kingman, who was retired on account of age, March 6.

General Black was appointed chief engine
officer of the Department of Havana follow oint.
the Spanish-American War in 1899, he re-
started his constructive work in that c on the
by cleaning up the city and repairin ward he
buildings and wharves. In 1900 he w the U. S.
chief engineer officer of the Divisior vements in
in which capacity he organized th after, was
Department of Public Works a health. In
charge of the preparation of the p gineer on the
complete sewerage system and the e across the
paving work in Havana, which is now Charles-
completed, with modifications. When
United States forces were withdrawn many
the projects he had started to develop had no
reached a head. He rounded out and completed his work on the island during the Intervention several years later.

Reinforced-Concrete in Fortifications

He was born in Lancaster, Pa., in 1855, and received his early education in the public schools of that city and at Franklin and Marshall College. He was appointed to the United States Military Academy in 1873, and was graduated at the head of his class in 1877, after leading it during the entire course. He was then appointed second-lieutenant in the Corps of Engineers, and was assigned to duty as assistant instructor in practical military engineering at West Point. In 1888 he was promoted to the grade of first lieutenant and assigned to duty on the improvement of the Great Kanawaha River. In 1886, while on duty on the restoration of Fort Marion at St. Augustine, Fla., he used reinforced-concrete for the first time in United States fortifications. In the same year he was promoted to the rank of captain, and engaged in river work, fortifications and harbor improvements until 1897, when he was made engineer commissioner of the District of Columbia. In this capacity he prepared plans for the elimination of grade crossings in that district which were accepted by the railroads and approved by Congress.

Spanish-American War Service

In 1898, at the outbreak of the Spanish-American War, he was brevetted lieutenant-colonel and chief engineer of U. S. Volunteers, and had charge of gathering the engineer material for the field army previous to the Santiago Expedition. In that campaign he commanded the advance guard at the landing at Guanica in which the Spanish troops were driven from the town after a slight skirmish. He was commended by the general commanding the army in his annual report for his conduct of the action.

Begins Work in Cuba

After a brief period of temporary duty in the office of the chief of engineers in Washington, in 1898, he was appointed chief engineer of the Department of Havana and began his work in Cuba by cleaning up the city and repairing its public buildings and wharves. About a year later he was appointed chief engineer officer of the Division of Cuba, on the staff of Major-General Wood, and supervisor of the Department of Public Works. In this capacity he organized the Department of Public Works and prepared a code of regulations for the conduct of work, which remained in force until incorporated in the general law of executive power of the Republic toward the close of the Intervention in 1909. He also had charge of the preparation of the plans for the sewerage and paving of Havana, a $16,000,000 undertaking which is now being completed, and of the planning and construction of the widely famed Malecon, which transformed an ugly dog-tooth coral littoral into a plaza and driveway that has become the best residential section of the city, and is a favorite resort of the Havana people and tourists during the evenings when band concerts are held there.

Work on Panama Canal

Being relieved from this service in 1901, he returned to the United States, and, in 1903, assigned to duty in Panama under the a ian Canal Commission to observe the hantions of the French Canal Company. As tha short period in 1904 he was acting was scineer for the commission. While on The planama he received a testimonial from ing, a pa consuls and residents of Colon for mer bein took in the defense of foreign resisame mant a threatened attack of Columb-

In p as appointed to the rank lieutenant-plant in 1905, and, in 1906, at the beginning fo he American Intervention he was assigned Cuba as advisor of the Department of Public Works of the Provisional Government. During this assignment he devised the first comprehensive system of highways built in Cuba and prepared, in collaboration with the then Colonel Crowder, modifications to the contract for sewering and paving Havana, and for the water supply and sewerage of Cienfuegos. It was at this time that the Department of Public Works probably reached its high point in volume of construction under way at one time. The works covered the entire island and included municipal improvements, waterworks, flood prevention, canals, drainage, harbor improvement, and highway construction.

Chief Engineer Officer at New York

During the Intervention he was promoted to the rank of colonel in the Corps of Engineers, and, at its end, he was appointed chief engineer officer of the Department of the East and South and, in 1911, chief engineer officer of the Eastern Division. In this office he had charge of the first New York district river and harbor improvements. He also served as a member of the New York Harbor-line board, member of the board for the examination of engineer officers for promotion and senior member of the board for the preparation of a projected intracoastal waterway between Boston, Mass., and Beaufort, N. C. Later he was senior member of the board charged with removing the wreck of the "Maine" from Havana Harbor and a member of the board to consider the modification of the harbor lines of Boston. In 1883 he was awarded the Rowland prize by the American Society of Civil Engineers for his paper on harbor improvements along the South Atlantic Coast, and, in 1912, Franklin and Marshall College conferred on him the degree of Doctor of Science.

Studied Sewage Aeration

General Black, several years ago, undertook in connection with studies of the pollution of New York Harbor, an investigation of sewage treatment by aeration, in which he worked jointly with Prof. Earle B. Phelps of the U. S. Public Health Service. The results were reported in a paper presented to the Municipal Engineers of the City of New York.

Waterworks Association to Give Prizes for Securing Members

To increase its membership among the 6000 waterworks in the United States the American Waterworks Association proposes to give a cup to that section reporting the largest increase in membership per member and a gold society badge to that member in each section who secures the largest number of new members. The association now has members representing only 8 per cent of the waterworks men of the country and a strenuous effort will be made to materially increase its membership before the meeting in New York City, June 5 to 9.

200 Guests at Banquet in Tunnel

Covers were set for 200 guests at the banquet held 100 ft. underground in the Mill Creek joint district sewer, St. Louis, Feb. 19.

The tunnel is 3.8 miles in length, of horseshoe shape, 16½ ft. by 16½ ft. in section. It was driven through solid rock, and the material was hoisted to the street level in 9 shafts along the line of the work. The concrete lining was placed by the compressed air method, and new records were made both for the driving and the lining.

TABLES SET FOR BANQUET IN TUNNEL

The general contractors for the work were the Carter Construction Company and Norton, Head & Denneen, of New York. The banquet hall was on the section constructed by the Brocklehurst & Potter Company, of New York City.

Los Angeles Sanitation Commission Reports on Sewer Problems

The commission of sanitation engineers, which was recently appointed to report on what would be necessary in the laying out of an outfall sewer system for the entire county, mention of which appeared on page 231 of the Engineering Record of Feb. 12, submitted its preliminary report to the Board of Supervisors on Feb. 29. The commission recommends an appropriation of $45,000 to finance for a year a study of the problems involved.

The funds would be expended as follows: Five commissioners should be employed at $3,000 each, to which body there should be attached an executive secretary, a number of draftsmen, assistant engineers and others, to cost about $14,000, of which $2,000 would be for the secretary's salary. The remainder of the funds would be distributed in making several investigations; namely, tidal currents, $5,000; sewer lines and disposal sites, $3,000; soil analyses and ground water conditions, $1,000; transportation, traveling expenses and incidentals, $4,500; printing of report and miscellaneous, $2,500.

After a discussion of the report it was unanimously agreed by the board that all of the communities of the county should have a voice in the final decision as to what should be done. The clerk of the board was requested to send notices to all the communities, suggesting that the representatives sent should in each instance be delegated with power to act for the town in appointing the commission to complete a final plan.

Engineers Urge Support for Bills to Increase Military Training

Twenty prominent members of the various American engineering societies, including B. J. Arnold, E. L. Corthell, A. C. Humphreys, R. D. Mershon, George F. Swain, William Barclay Parsons, and W. J. Wilgus, have issued a circular to all members of the societies requesting them to send personal letters or telegrams to their individual senators and representatives urging support for the bills introduced in Congress to provide for the extension of military training in land-grant colleges and other civil educational institutions. The wording of these communications may be somewhat as follows: "I urgently request you to support and vote for the plan covered by the Bill S-3946 introduced by Senator Pomerene, and H. R.-10,845 introduced by Representative Gard, providing for the extension of military training in civil educational institutions."

In addition, it is urged that letters should be sent to other members of Congress who might be influenced, and that as many other persons as possible be induced to take similar action.

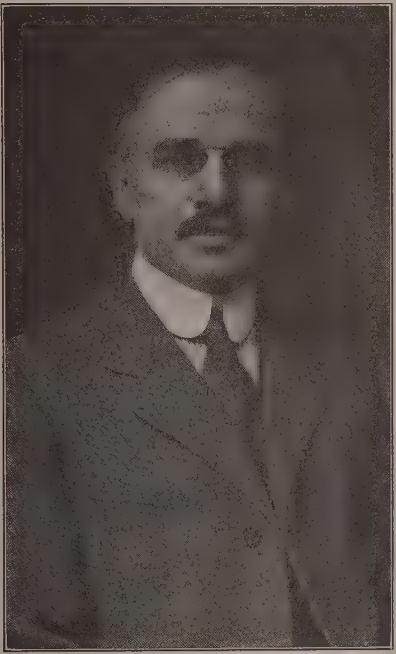
The principal points covered by the bills are as follows:

1. That the President of the United States shall have authority to establish and maintain in civil educational institutions a reserve officers training corps, which shall consist of a senior division and a junior division. The senior division shall be established only in institutions which require four years of collegiate study for a degree, and which will comply with the conditions laid down in the bill. The junior division may be established in all other educational institutions which will comply with the specified requirements.
2. The work of the senior division requires an average of at least 5 hr. per week during two academic years. The men undergoing this training will be supplied by the government with their uniforms, and will have their expenses paid to, and from, and at the summer training camps to be established as a part of the training. The work of the junior division requires an averge of at least 3 hr. per week per academic year.
3. That the President of the United States is authorized to detail such number of army officers, of non-commissioned officers and of enlisted men as may be necessary in connection with the military education and training of the members of the Reserve Officers Training Corps.
4. That the Secretary of War shall have the authority to prescribe standard courses of theoretical and practical military training for the units of the Reserve Officers Training Corps, and to establish camps in which further practical instruction of the members of the training corps shall be given.
5. That the President shall have authority to appoint as a reserve officer anyone who volunteers for such appointment who has taken the training of the senior division, and has otherwise fulfilled the requirements laid down and that the President may appoint as a temporary second lieutenant in the regular Army any reserve officer appointed under the provisions of the bill.

J. V. W. Reynders Resigns Superintendency of Steelton Plant

J. V. W. Reynders, vice-president and director of the Pennsylvania Steel Company, resigned as general superintendent of the Steelton, Pa., plant, March 7. With the announcement of Mr. Reynders' resignation came notification of the appointment of Quincy Bent, assistant to F. W. Wood, president of the Maryland Steel Company, Sparrows Point, Md., as general manager of the Pennsylvania Steel plants at Steelton and Lebanon, Pa., a position created by the Schwab interests.

General Superintendent of Steelton Plant of Pennsylvania Steel Company Resigns



J. V. W. REYNDERS

Mr. Reynders' resignation is the first important change in the personnel of the Pennsylvania Steel plants since their purchase by the new interests. It is in line with the general policy, recently announced, of concentrating the executive officers of all recently acquired properties at South Bethlehem, Pa. Mr. Bent will have complete control over the management of the Steelton and Lebanon plants, but will be without the additional executive authority vested in Mr. Reynders. It is this fact, of lessened authority, that is believed responsible for Mr. Reynders' resignation.

Mr. Reynders was born in Hoboken, N. J., and was educated at the Gymnasium at Wesel, Germany, and at Rensselaer Polytechnic Institute. He was first employed as a designer by the Pittsburgh Bridge Company in 1886, and, after two years, went to the Snead & Company Iron Works at Louisville, Ky. Later he was with the Penn Bridge Company, of Beaver Falls, Pa. Following this service he became assistant in charge of construction of the bridge over the Ohio River and of the St. Louis Merchants' bridge. Later he was with the Union Bridge Company, of Buffalo, N. Y., and Athens, Pa., and the Edge Moor Bridge Company, of Wilmington, Del. When the bridge and construction department of the Pennsylvania Steel was organized in 1892, he was appointed engineer, and, a year later, superintendent in charge. In 1906 he was made director and vice-president in charge of the Steelton and Lebanon plants.

To Mr. Reynders is generally credited the rapid upbuilding and strengthening of the Pennsylvania company's properties. When he first became a factor in the company's policy the various plants were in poor condition physically and the organization not fitted for playing an important part in the steel business. He leaves the properties as a going concern of the highest standing in plant and personnel.

While his business duties have been heavy, Mr. Reynders has nevertheless taken time to participate in civic affairs and in the activities of engineering societies. He is one of the leading citizens of Harrisburg and has been an important factor in the promotion of the many municipal improvements undertaken there in recent years. He has been prominent in the Engineers' Society of Pennsylvania, twice serving in the capacity of president.

Searchlights and Coast Defense Play Big Part in Modern Warfare

A blizzard of no small proportions failed to prevent a large attendance at the fourth military lecture, held under the direction of the four national engineering organizations at the Engineering Societies Building, New York City, Monday night. Following an introductory address on the nation's military status by Colonel Glenn, Gen. Leonard Wood's chief of staff, Capt. Edward F. Ardery, Corps of Engineers, U. S. Army, explained present-day practice in battle-field illumination and sea coast defense. The presiding officer at this session was Robert Ridgway, engineer of subway construction for the New York Public Service Commission.

Among modern devices for lighting hostile positions Captain Ardery enumerated searchlights, flares, torches, rockets and bombs, some of which have parachutes attached to them so as to support them in mid-air for 40 sec. In the latest types of searchlights the engines driving the motor trucks among which the apparatus is transported are made to supply power for illumination. The advocates of industrial preparedness in the audience were particularly impressed by one of Captain Ardery's pictures showing a special form of searchlight equipment designed for use in the Spanish war and delivered by the manufacturers to the Army after peace had been declared.

Captain Ardery explained in detail the construction and operation of sea-coast defenses, including both the guns and their emplacements. Accurate range-finding is the basis for directing a shell to its mark and the system of observation and almost instantaneous plotting of a ship's position off shore was one of the features of the address.

Captain Ardery concluded his lecture with a description of various types of mines and the methods of placing and exploding them.

Railway Engineering Association Announces Program

The American Railway Engineering Association has announced the program for its seventeenth annual convention, to be held at the Congress Hotel, Chicago, March 21-23. Subject to change by vote of the convention, or by the time requirements of the reports, the committees will report in the following order:

Tuesday, March 21—signals and interlocking, signs, fences and crossings, water service, iron and steel structures, wooden bridges and trestles, masonry.

Wednesday, March 22—ties, conservation of natural resources, yards and terminals, uniform general contract forms, stresses in railroad track, rules and organization, roadway, ballast.

Thursday, March 23—track, buildings, electricity, grading of lumber, records and accounts, wood preservation, rail, economics of railway location.

Two illustrated papers will be presented at an evening session March 21. Robert W. Hunt will speak on "The Nick and Break Test in the Inspection of Steel Rails," and H. B. MacFarland will discuss a "Test of Douglas Fir Bridge Stringers."

The annual dinner will be held March 22 at 6.30 p. m. The speakers will include Dr. John A. Brashear, scientist and astronomer, Pittsburgh; Arnold W. Brunner, of the city plan commission, New York City; Hon. Rudolphe Lemieux, formerly postmaster-general of Canada, and Rev. Allen A. Stockdale, of Toledo, Ohio.

Following the convention the members will be given an opportunity to visit the exhibit of the National Railway Appliances Association at the Coliseum.

William Sooy Smith Dead

Gen. William Sooy Smith, one of the country's foremost foundation specialists, died at Medford, Ore., March 4. In the course of his career as an engineer he invented a pneumatic caisson, which was probably the first ever used, and revolutionized the method of constructing foundations for heavy buildings in Chicago. He also introduced the freezing process for excavating in water bearing soil in this country.

He was born at Tarlton, Ohio, in 1830, and received his professional education at the United States Military Academy at West Point. After a year of service in the army, he resigned to engage in engineering work on the Illinois Central Railroad. Soon afterward he was appointed assistant engineer to the U. S. engineer in charge of the improvements in Lake Michigan harbors, but, soon after, was forced to resign on account of his health. In 1857, he was appointed chief engineer on the construction of an iron bridge across the Savannah River for the Savannah & Charleston Railroad Company.

Noted Foundation Specialist Who Died March 4

GEN. WILLIAM SOOY SMITH

At the outbreak of the Civil War he was appointed a colonel of infantry, and during it he distinguished himself on several occasions and was promoted through the grades until he attained the command of a division, serving on the staffs of Generals Grant and Sherman as chief of cavalry in the military division of the Mississippi. His duties in this connection brought him near to death from inflammatory rheumatism and incapacitated him for future service. Holding that an officer permanently disqualified for the discharge of all the duties of his rank should step aside and allow the man who does the work to enjoy the rank and pay, he resigned his commission against the advice of General Sherman.

When sufficiently recovered in health, he resumed practice as a civil engineer in Chicago and did considerable work as engineer and contractor for the U. S. Government and the railroad companies, including the reconstruction of the Waugoshanee lighthouse at the western entrance of the straits of Mackinac, the first all-steel railway bridge in the world at Glasgow, Mo., and the substructures of six other bridges by the pneumatic process. Also he completely changed the methods of constructing foundations for heavy buildings in Chicago, carrying the loads down through mud and soft earth to hard bottom, 50 ft. or more, by means of piles cut off below the water surface. Where these could not be driven without endangering the foundations of adjacent buildings, they were carried down by sinking columns of concrete to hard bottom and resting the buildings on them.

His first pneumatic caisson, probably the first ever used, was for the construction of the heavy sea-wall surrounding the Waugoshanee lighthouse. In 1872, he was instrumental in causing Congress to appropriate money for a thorough test of iron and steel, and, after the necessary legislation had been obtained, he served for three years as one of the members of the board to conduct such tests. He joined the American Society of Civil Engineers in 1872, and was also a member of the American Institute of Mining Engineers and the Western Society of Engineers.

Report Shows Exposition Conventions Established Records

A final report of convention activities at the Panama-Pacific International Exposition, recently submitted to Charles C. Moore, president of the Exposition, showed that conventions brought 800,000 visitors to San Francisco, and that these visitors spent approximately $30,000,000 in that city. The total number of congresses and conventions was 928, which is said to be more than double the number of the St. Louis Exposition and nearly five times the number at the Chicago Exposition. Scarcely a day passed without a convention, it is affirmed, and as many as forty conventions were held in a single day, the average being ten sessions daily for the 288 days of the Exposition. The attendance at the sessions varied from 25 to 15,000. Of the 928 conventions scheduled, 61 were held by international organizations, 541 by national organizations, 94 by Pacific Coast organizations and 232 by California organizations. The International Congress of Education was attended by delegates from 31 foreign nations and the International Press Congress by delegates from 29 foreign countries. The maximum monthly attendance was in August, when 277 conventions were held.

Engineering Society of Wisconsin Doubles Its Membership

Two years ago a half-dozen members of the Engineering Society of Wisconsin met in Milwaukee and seriously discussed disbanding the organization. On Feb. 25 and 26 eighty engineers of all classes attended the meeting at Madison and it was announced that the total enrollment is now nearly 130, a figure double that of a year ago. It is significant that the increase has been largely among contractors.

Comparatively few papers were presented, thus giving plenty of time for discussion. This idea was taken advantage of to such an extent that none of the committee reports were presented except by title.

A paper on the "Relation of Engineers and Contractors," by J. C. Pinney, outlined methods of fair dealing by which these relations can be made as agreeable and pleasant as possible without sacrificing the interests of the owner or the terms of the contract, and without requiring undue or unfair concessions from the contractor. Points brought out in the discussion emphasized that the engineer should be the impartial arbitrator; that extras should be allowed on general merits and not be traded; that general terms in specifications should be discouraged; that engineers should be responsible for the results of the contractor and not for the methods he uses.

H. W. Adam, Mayor of Beloit, presented a paper on "Beloit's Experience with Open Paving Specifications," which brought out the liveliest discussion of the meeting, although little matter new to the engineer developed.

The newly elected officers are as follows: President, John S. McCullough, city engineer, Fond du Lac; vice-president, A. A. Babcock, engineer, Wisconsin Valley Improvement Company, Wausau; trustees, Fred G. Simmons, director public works, Milwaukee, and E. E. Parker, city engineer, Madison.

Boulevard to Overlook San Francisco from Twin Peaks

San Francisco's system of boulevards is being extended by a wide scenic highway which encircles Twin Peaks in the shape of a figure eight, overlooking both the city and the ocean shore from an elevation of about 800 ft. The length of roadway in the double circle is about 1 mile, and this will connect with the boulevards which, as extensions of the state highway from peninsular points, extend along the ocean beach to the Exposition Marina and back into the city via Van Ness Avenue.

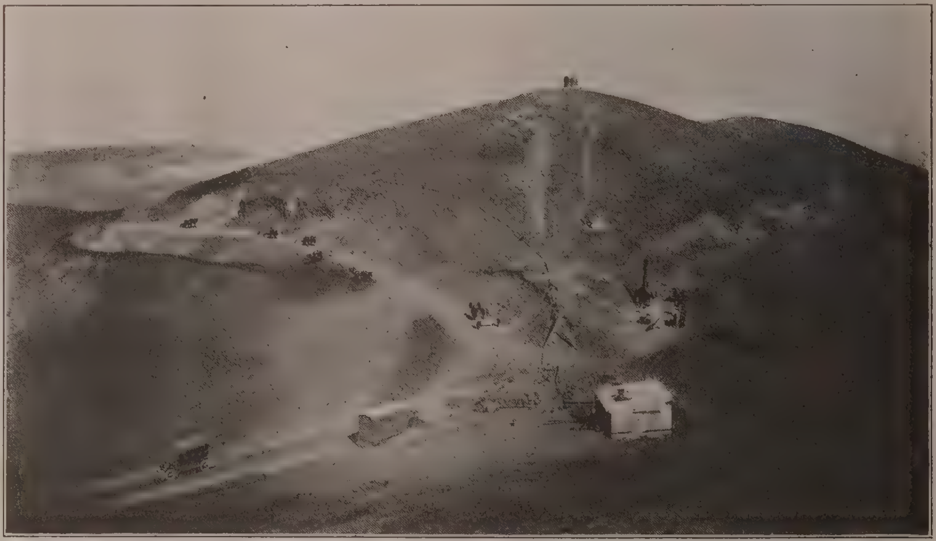


FIGURE EIGHT BOULEVARD LINKS TWIN PEAKS

The figure eight boulevard will be ready for service about April 15. It will be 40 ft. wide, with a paved width of 25 ft. The base will be of concrete, 6 in. thick, over which 1 in. of asphalt will be placed and finished with a 1½-in. binder wearing surface. The maximum grade in the approach to the road around the summits will be about 8 per cent, although 9 per cent is being used for very short distances at several points. Almost the entire right-of-way for the road was donated by the property owners.

The boulevard is being built by the city of San Francisco under the direction of M. M. O'Shaughnessy, city engineer.

Fort Worth, Texas, to Issue Building Permit Without Charge

In order to encourage building operations at Fort Worth, Tex., the city commission has decided to issue all building permits without charge. This will mean a loss of about $1,800 in revenue per annum.

Shields Water Power Bill Passed

By a vote of 46 to 22 the Senate passed the Shields water power bill, March 8.

Pennsylvania Engineers' Commission Submits Recommendations

The Pennsylvania Engineers' Commission, appointed to investigate the licensing of engineers in that state, has submitted a report to the Governor in which it is recommended that engineers in the public service, where competency may be readily determined by examination, should be subject to civil service regulations. Engineers in the employ of public service companies should be exempt from registration until the system has been tried out in state and municipal governments. Consulting engineers and experts for temporary engagements should be exempted from examination, and it is recommended that appointments to positions of high rank should be made at the initiative of the department as officer seeking to have the position filled. Some of the conclusions reached by the commission are as follows:

It is desirable in general, for the better protection of the life, health and property of the citizens of the Commonwealth, that the employment, retention and discharge of engineers, surveyors and technical men in public service, where competency may readily be determined by examination, should be subject to state or municipal civil service regulations.

In cities of the first and second class, and in the counties, boroughs, townships and municipalities of Pennsylvania, and for state work, it is desirable that such civil service examinations be conducted by a state department in order that the examinations may be governed by reasonable and consistent standards and a single body charged with the enforcement of such standards.

Such engineers, surveyors and technical employees of the state, counties and municipalities, excepting those in administrative positions, should be required to qualify before such a department. The determinations of standards and classifications should be in the hands of the board, but appointments to engineering or technical positions above a certain rank should not be governed by competitive civil service examinations. These appointments should be made on the basis of professional records. It is desirable that such appointments should be made at the initiative of the state or municipal department or officer seeking to have the position filled, but with the approvel of the state civil service examination board.

In cities of the first and second class the civil service examinations may properly be conducted as at present under independent local management.

Consulting engineers and experts for special temporary engagements should be exempt from examination, but should be required to register with the state board before beginning to practise. They should file a sworn statement of their professional record, and confirmatory statements from others, if called for, and unless promptly disapproved, this filing should be sufficient precedent to practice. The board should have power, for adequate cause, after hearing, to cancel the registration, and also to issue certificates to such experts if desirable.

The exemption of public service companies from the provisions of civil service regulations at the present time is suggested with the thought in mind that a beginning having been made in public works, prudence dictates a reasonable period of time in which to observe a working out of the system before any extension of it is considered.

Plans and specifications for public works built or to be built, operated and maintained by public service companies and municipalities, should, under the provisions of existing laws, be handled in the proper and respective departments of the state government.

It is desirable that the state civil service examination department, board or commission, should be authorized to investigate charges of incompetency or official dereliction on the part of engineers or technical men appointed through civil service, excepting cities of first and second classes, and that it alone should be empowered to disqualify such public servants, and only for adequate cause.

It is further desirable that the state civil service examination board should act in an advisory capacity in connection with the employment of consulting engineers or experts for special temporary engagements, and that no such engagements should be legal if made or continued against its disapproval.

The commission making the recommendations includes: F. Herbert Snow, chief engineer of the Public Service Commission of Pennsylvania, and for years head of the bureau of sanitary engineering of the State Health Department, chairman; John Price Jackson, commissioner of the State Department of Labor and Industry; Samuel A. Taylor, consulting engineer, of Pittsburgh; George S. Webster, director of Wharves, Docks and Ferries, Philadelphia, and J. Murray Africa, consulting engineer, of Huntingdon.

Western Road Installs Automatic Signals

The Chicago-Great Western Railroad has purchased and will commence in April the installation of automatic safety signals to extend its block system to cover entirely the main line from Chicago to St. Paul and to protect also most of the line from Chicago to Waterloo and Des Moines. The road has also purchased 10,000 tons of 85-lb. rails to replace curve-worn and light rail between Chicago and St. Paul.

News of Engineering Societies

The Engineers' Club of Philadelphia will hear Major-General William C. Gorgas, U. S. A., speak on "Sanitation" at a meeting to be held in that city, March 21.

The Municipal Engineers of the City of New York will inspect the Y. M. C. A. Building at Hanson and Fort Green Places in the Borough of Brooklyn, New York City, March 14.

The Pacific Northwest Society of Engineers heard Capt. John E. Pratt speak on "Engineering Features of Our Coast and Geodetic Survey" at a meeting held in Seattle, Wash., March 4.

The Engineering Alumni of the University of Vermont will hold its annual dinner at the Machinery Club, 50 Church Street, New York City, March 28, at 6.30 p. m. The engineering faculty of the university will attend.

The Illinois Structural Engineers' Association through its board of fifteen directors, has elected the following officers: President, J. G. Giaver; vice-president, J. P. Cowing; treasurer, H. E. Vanderlip; secretary, R. M. Gerety.

The Detroit Engineering Society will hear John H. Weller, supervisor of labor at the Packard Motor Car Company's plant, on "Modern Shop Tools and Method for the Production of Automobile Parts" at a meeting to be held in that city, March 17.

The Brooklyn Engineers' Club heard E. E. Trafton, telephone engineer of the Brooklyn Rapid Transit Company, speak on "Telephone Train Dispatching and Safety Appliances, New York Municipal Subways" at a meeting held in the Borough of Brooklyn, New York City, March 9.

The Colorado Association of Members of the American Society of Civil Engineers will discuss this evening questions pertaining to the affairs of the society. Discussion on the proposed change of society headquarters will be opened by J. E. Field, chairman of a committee to obtain information from all possible sources.

The Southern California Chapter of the American Institute of Architects held an architectural exhibition at Los Angeles during the period between Feb. 15 and March 4. The exhibit included architectural drawings, mural decorations, products used in building and allied arts and crafts, and the elevation and drawings of buildings of every character from the smallest bungalow to modern skyscrapers. About 1000 invited guests inspected the exhibit on the opening night at which time fifty architects acted as hosts. On the following day the display was thrown open to the general public.

Personal Notes

W. A. PEIRCE, formerly city engineer of Columbus, Wis., has been appointed to a position in the valuation department of the Green Bay & Western Railroad on work preparatory to the valuation by the Interstate Commerce Commission.

B. J. DALTON, formerly assistant district engineer of the western district of the Division of Valuation of the Interestate Commerce Commission, at Kansas City, has been appointed chairman of the valuation committee of the Missouri, Kansas & Texas Railways. Mr. Dalton was graduated from the University of Kansas in 1890, and entered railway service the same year. In 1891 and 1892 he was division engineer on the Texas, Louisiana & Eastern, and, in the latter part of 1892, he was on location work in New Mexico. From 1893 to 1895 he was engaged in general practice. In the latter year he was appointed division engineer on the Kansas City, Pittsburgh & Gulf, and, in 1898, chief engineer of the Kansas, Oklahoma Central & Southwestern. When that road was sold to the Santa Fé System he remained with the new interests as resident engineer on construction. From 1900 to 1903 he was assistant chief engineer of the St. Louis & North Arkansas, and of the Arkansas & Choctaw. He retired from that service to become, for two years, city engineer of Lawrence, Kan., after which he returned to the railroad field as division engineer of the Denver, Enid & Gulf. In 1906 he was appointed chief engineer of that road. Later in the same year he resigned from the office to become associate professor of civil engineering at the University of Kansas. Subsequently he became professor of civil engineering at that university. He was appointed assistant district engineer of the western district of the Division of Valuation in 1914.

H. M. MONTGOMERY AND C. W. HUMPHREY, consulting and contracting engineers, have formed a partnership under the name of Humphrey & Montgomery, with offices at 327 South La Salle Street, Chicago. They propose to continue and extend the practice of Mr. Humphrey, specializing in the design and construction of hydroelectric, steam and industrial plants, in electric transmission and distribution, in waterworks, and in reports and valuations.

D. B. DUNCAN, formerly connected with the W. D. Lewis Company of New York City, has been elected vice-president of the Eberhardt Construction Company, general contractors, of Salina, Kan. Mr. Duncan was graduated from the University of Missouri in 1905, and served for four years on the construction of the Pennsylvania Railroad tunnels under the East River, New York City. In 1909 he was appointed city engineer of Columbia, Mo., and was also connected with the L. W. Dumas, Jr., Construction Company of that city until 1913, when he joined the forces of the W. D. Lewis Company.

DANIEL W. MEAD AND F. W. SCHEIDENHELM have opened offices in the Equitable Building, 120 Broadway, New York, for the continuation of their practice as consulting engineers. Mr. Mead has been in engineering practice about thirty years, during part of which time he was engaged in contracting work. Since then he has been engaged in consulting practice at Madison, Wis., in addition to fulfilling the duties of professor of hydraulic and sanitary engineering at the University of Wisconsin. His field of engineering work has been extensive, but his main work has been along hydraulic and hydroelectric lines. In 1914, as a member of the board of consulting engineers acting for the American Red Cross and for the Chinese Republic, Mr. Mead spent some months in China investigating the problem of flood control and river regulation along the Huai River. He is also now acting as consulting engineer for the Miami Conservancy District, which is handling the problem of flood protection at Dayton, Ohio. As an author, Mr. Mead is best known for his book on "Water Power Engineering," though he has written a number of other books and many papers on hydraulic and related subjects. He will divide his time between Madison and New York. Mr. Scheidenhelm comes to New York from Pittsburgh, which has been his headquarters for a number of years, and where he has been engaged in private and consulting capacities in hydroelectric and other hydraulic work. For several years, as vice-president and chief engineer of the Hydroelectric Company of West Virginia, he was in charge of the Cheat River developments of that company. He has been specializing to a considerable extent in dam design and construction. Recently, he completed the reconstruction of the Stony River dam, which failed in January, 1914. Both Mr. Mead and Mr. Scheidenhelm are graduates of Cornell University, and members of the American Society of Civil Engineers, as well as of many other technical societies. They will continue to give their attention to hydraulic and electric developments, water supply, flood prevention and reclamation works.

RICHARD D. WILSON, superintendent of construction for the U. S. Treasury Department, Office of the Supervising Architect, has completed his assignment on the Federal Building at Hanford, Cal., and has been placed

H. H. EVANS, secretary of the local transportation committee of the Chicago city council, will act as secretary of the Chicago Traction and Subway Commission. Mr. Evans was graduated from Annapolis in 1899. He was a commissioned officer in the navy during the Spanish-American war, resigning in 1904 to go with the Cananea Copper Company, Mexico, for 1½ years. He then became assistant superintendent of construction for the Allis-Chalmers Company for three years. In 1908 he went to Chicago, and became special representative for the city in making a report on terminal electrification. Since then he has held his present position.

P. M. TEBBS, formerly assistant engineer in charge of district 12 of the Pennsylvania State Highway Department at Scranton, has been promoted to the grade of engineer of construction, with headquarters at Harrisburg, filling the vacancy caused by the resignation of John T. Gephart, Jr., which was noted in these columns, Feb. 5.

Ray Vosler, formerly civil engineer and surveyor of Greenville, Pa., has been appointed to a position on the forces of the Carnegie Steel Company at the works at Youngstown, Ohio.

Curtis A. Mees, whose resignation as designing engineer of the Southern Power Company was noted in these columns last week will engage in practice as consulting engineer at Charlotte, N. C., after May 1. Mr. Mees was graduated from Rose Polytechnic Institute in 1900, and was engaged in railway work on the Pennsylvania Lines west of Pittsburgh and the New York Central & Hudson River Railroad from then until 1902, when he was appointed assistant engineer for the Catawba Power Company in South Carolina. From 1904 to 1905 he was with the Department of Public Service of Columbus, Ohio, on the construction of its $1,500,000 sewage dosposal plant, and on waterworks design. He became connected with the Southern Power Company in 1905, when that company was organized. Among the plants he designed since then are the Great Falls, the Rocky Creek, Lookout Shoals, Fishing Creek and the Mount Holly steam plant.

Dayton Morgan Engineering Company, has recently been incorporated under the laws of Ohio, with headquarters at Dayton, with the following officers: Arthur E. Morgan, president; L. L. Hidinger, vice-president; C. A. Bock, secretary; S. B. Hutton, assistant secretary, and N. H. Sayford, treasurer. The new corporation, the creation of which was made advisable by the increasing scope of operations, will co-operate with the Memphis Company as "The Morgan Engineering Companies," and the two organizations will continue to specialize in flood prevention, drainage and reclamation engineering. The officers are the same in both organizations, except that S. B. Hutton is secretary of the Memphis Company. Mr. Morgan will continue as chief engineer of the Miami Conservancy District.

G. F. Clevenberg, until recently in the engineering department of the Central Railroad of New Jersey, is now on the government valuation work. He is at present on the roadway party in southern New Jersey that is inventorying the Central Railroad of New Jersey.

A. D. Collman and W. C. Duncan, formerly Collman & Collman Company, will hereafter be known under the firm name of Collman & Duncan, with offices in the Sharon Building, San Francisco, where they will conduct a general contracting business.

Paul A. Buol, formerly assistant chemist for the Portland Cement Company at Lehunt, Kan., has been appointed to a position in the engineering department of the St. Louis & San Francisco Railroad.

W. R. Schnabel, of Bethlehem, Pa., has been appointed first assistant city engineer of Allentown, Pa., succeeding Earl Meckley, resigned. Mr. Schnabel is a graduate of Lehigh University, and, for four years, was engaged in municipal work in Bethlehem, including street paving, sewers and general municipal improvements. For several years he was on construction work for the Bethlehem Steel Company, and lately has been office engineer for the Lehigh & New England Railroad, with headquarters in Bethlehem.

J. E. Lawton, for the past 9 years inspector and chief inspector of the Panama Canal, has resigned to accept a position as consulting engineer and sales manager for Ward & Company, manufacturers' agents, at Washington, D. C.

John Johnston, formerly construction engineer for the California State Highway department, has been appointed construction engineer for the State Department of Engineering, and will have charge of the work at Ventura, Cal.

Clifford M. Holland, formerly assistant engineer, has been selected to fill the newly created office of "tunnel engineer" of the Public Service Commission of New York. In his new position Mr. Holland will have general supervision over all of the shield tunneling involved in the construction of the city's new subway system, representing contracts aggregating about $20,000,000 for this class of work in soft ground. The new Fourteenth Street bore on route 8, section 3, a contract for which has recently been awarded, and also a tunnel at Sixtieth Street, for which plans and specifications are now in course of preparation, are important features of the construction program for which the new tunnel engineer will be responsible. Other contracts under his direction are those for route 33, sections 2 and 3, and route 48, section 3. Mr. Holland's promotion comes as a recognition of ten years' continuous service on New York subway work. He is a graduate of Harvard University, having received his degree of A.B. in 1905, and S.B. in Civil Engineering in 1906. While in college he served on Prof. Hector J. Hughes' staff of field instructors in surveying at the University's engineering camp at Squam Lake, N. H. After leaving college his first work was with the New York Rapid Transit Commission, as assistant engineer in the Battery tunnel, and when the Public Service Commission took over the subway work he was retained on the engineering staff, supervising construction both in Manhattan and Brooklyn. Year by year he demonstrated his ability to shoulder increased responsibilities, and when it was decided that the best interests of the subway construction demanded the centralization of all soft-ground tunneling under a single administrative head, Mr. Holland was considered to be the logical choice for the new post. He is an associate member of the American Society of Civil Engineers and secretary of the Harvard Engineering Society of New York.

Assumes charge of all Soft Ground Tunneling on New York's New Subway System

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CLIFFORD M. HOLLAND

J. W. Mercer, formerly assistant county engineer of Fain County, Iowa, has been appointed county engineer of Lucas County.

William C. Spiker, consulting engineer, of Atlanta, Ga., has been appointed construction engineer on the Market Street bridge across the Tennessee River at Chattanooga, and will devote a good part of his time to that work. Mr. Spiker was graduated from Cornell University in 1900, and was employed for a few months by the Central Railroad of New Jersey. In the fall of that year he was appointed to a position on the forces of the American Bridge Company, where he remained until 1902, when he joined the staff of Joseph H. Wallace, consulting engineer, of New York City. From 1904 to 1905 he was engaged in design work for Milliken Brothers of New York City, the New York Central Railroad and the McClintic-Marshall Construction Company. From 1905 to 1908 he was again with Joseph H. Wallace on the design of manufacturing plants, the development of water powers and other work. During the last year he was in England in charge of all the work above the foundations on a $2,000,000 industrial plant. In 1908 he was appointed chief engineer for the Alfred E. Noble Company of New York. He entered private practice as consulting engineer at Atlanta, in 1909.

E. W. Clarke, chief engineer of the Cambria Steel Company, has been chosen to succeed Charles E. Duncan as superintendent of rolling mills of that company.

W. P. Howe, road engineer of Crockett and Irion Counties, Texas, has resigned his position to take charge of the first fish hatchery to be established in Oklahoma.

C. E. Apple has resigned from his position as supervisor of bridges and buildings for the San Antonio & Aransas Pass Railway.

S. V. Cortelyou, assistant engineer of the California State Highway Commission, in company with county officials, is making a tour of inspection of the bridges in San Diego County damaged during the recent floods for the purpose of determining what type and class of bridges will be necessary in the future to reduce the danger from such causes to a minimum. Under the law the State Highway Commission has authority to designate the character of structures erected by the counties over streams on the state highway, and Mr. Cortelyou is making his tour at the request of officials of San Diego County, who are anxious to complete an estimate of the cost of repairs and of new structures in order that a bond election may be held at an early date.

W. H. Carruthers has resigned from the office of county engineer of Maricopa County, Arizona, to become engineer in charge of construction in that State for the Barrett Manufacturing Company.

Harold Bargeman, formerly assistant county engineer of Maricopa County, Arizona, has been appointed county engineer, succeeding W. H. Carruthers, whose resignation is noted elsewhere in these columns.

John Tomson has been appointed commissioner of the streets division of the city of Cleveland, succeeding Gus. H. Hanna, who has become president of the Lake City Manufacturing & Supply Company. Under the reorganization plans, put in effect by the director of public service, the street cleaning and street repairing divisions are consolidated. The city will be divided into 15 or 16 districts, with a foreman in complete charge of all street work in each. Heretofore, all street cleaning and repair work has been directed from the city hall on a city-wide basis.

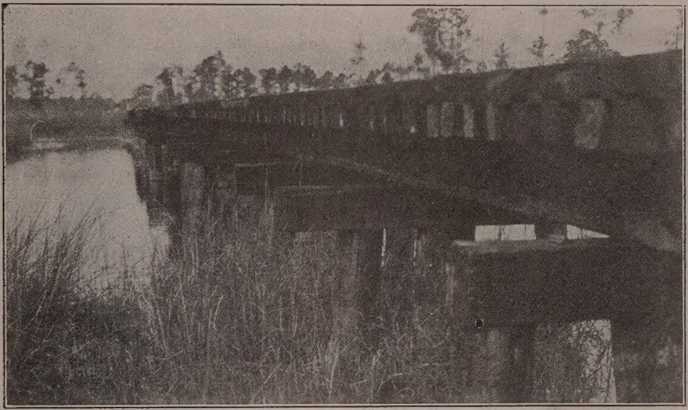
James H. Lawrence has been appointed assistant commissioner of the streets division of the city of Cleveland.

I. W. E. Davis, commissioner of heat and light of the city of Cleveland, will also assume the office of commissioner of water of that city in May or June.

CHARLES W. ERISMAN, formerly draftsman in the bureau of township highways of the Pennsylvania State Highway Department, has been appointed acting assistant engineer of district 6, with headquarters at York, succeeding W. A. Van Duzer, who has been transferred to Scranton.

GEORGE L. SOLLENBERGER, formerly a draftsman in the bridge department of the Pennsylvania State Highway Department, has been appointed assistant engineer in charge of district 2 of the bureau of township highways, with headquarters at Harrisburg.

R. B. HAMILL, formerly chief of party in the bureau of township highways of the Pennsylvania State Highway Department, has been appointed assistant engineer in charge of district 3 of that bureau, with headquarters at Pittsburgh.



TREATED TRESTLE IN THE DISMAL SWAMP, VIRGINIA

W. P. MILLER, formerly a draftsman in the bridge department of the Pennsylvania State Highway Department, has been appointed assistant engineer in charge of district 4 of the bureau of township highways, with headquarters at Warren.

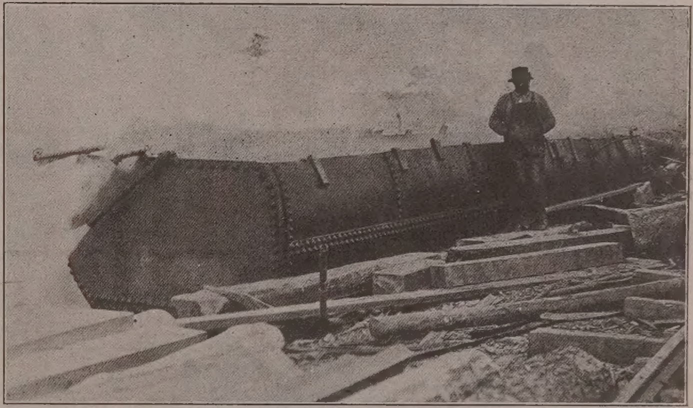
QUINCY BENT, whose appointment as general manager of the Steelton and Lebanon plants of the Pennsylvania Steel Company, succeeding J. V. W. Reynders, is noted elsewhere in these columns, was educated at the Harrisburg Academy and Williams College. He began his work at the Steelton plant of the Pennsylvania Steel Company, at Steelton, and later was transferred to Sparrows Point to become assistant to President Wood.

HARRY G. HARPER, formerly attached to the Harrisburg office of the Pennsylvania State Highway Department, has been appointed assistant engineer in charge of district 5 of the bureau of township highways, with headquarters at Bloomsburgh.

J. CLARENCE JONES, formerly city engineer of Edgerton, Wis., has been appointed to a position in the valuation department of the Chicago & Northwestern Railway. He was graduated from Kansas State College in 1913, and was employed during the next year by the Anderson Land Company of Cedar Rapids, Iowa, on land division and subdivision work, and on paving, sewerage and water supplies. He was appointed city engineer of Edgerton in 1914 and served in that office until February of the present year.

GEORGE M. NEEL, who, for the past four years, has been engaged on the construction of an irrigation project for the Ranchos Orchard & Land Company at Taos, N. M., has been appointed engineer for the Klauer Manufacturing Company, manufacturer of metal flume and other products, of Dubuque, Iowa. It will be his duty to investigate power and irrigation projects, draw up plans and supervise the installation of the company's flumes. His headquarters will be at Denver, Col.

H. H. WESLE, formerly connected with the Miami Conservancy District of Dayton, Ohio, has been appointed to a position on the engineering forces of the Union Pacific System at Omaha.



SIMPLE TANK IN WHICH TRESTLE TIMBER IS TREATED

Civil Service Examinations

Philadelphia.—Among the examinations announced on schedule 162, recently issued by the Civil Service Commission, which are dated for the near future, are the following. These examinations are open to residents of the city only. Application for them, which should be made at the City Hall, Room 976, must be completed before four days prior to their dates.

DRAFTSMEN, Highways Bureau, Department of Public Works, salaries from $600 to $900 and from $900 to $1,200 a year, to be held April 17. The duties for both positions involve drawing plans and other drafting work, besides assisting in data taking for highway work. Applicants must be 21 years of age and have had a high school training.

DRAFTSMAN, City Transit Department, salary from $1,000 to $1,200 a year, to be held April 18 and 19. This position is in connection with the designs of subways and elevated railways. The requirements are drafting work of this nature, estimating quantities, and making simple structural computations. For these requirements a year's practical experience or two year's education in a technical institution is demanded. Applicants must be 21 years of age.

DRAFTSMAN, Bridge Division, Bureau of Surveys, salary $1,200 a year, to be held April 19 and 20. Calculation of stresses of beams and girders in steel and reinforced concrete, as well as steel trusses, and designing of similar structures are duties attending this position. Applicants must have had a civil engineering education. Preference will be given to those who have had likewise experience in detailing structural work.

Examinations Previously Announced

Date		See Eng. Record
March 22-23	Junior civil engineers, Grades 1 and 2, salaries from $1,200 to $1,680 and from $720 to $1,080 a year; valuation work, Interstate Commerce Commission, United States	March 4
April 3-8	Architectural draftsmen, salaries from $900 to $1,200 and from $1,200 to $1,500 respectively, roadman; salary from $840 to $960 a year, and assistant engineers, salaries $2,100 to $2,500 a year, Philadelphia	March 4

New Process for Treating Wood Is Put Forth

Patented Method Is Extremely Simple and Those Backing It Claim for It a Wide Field of Usefulness

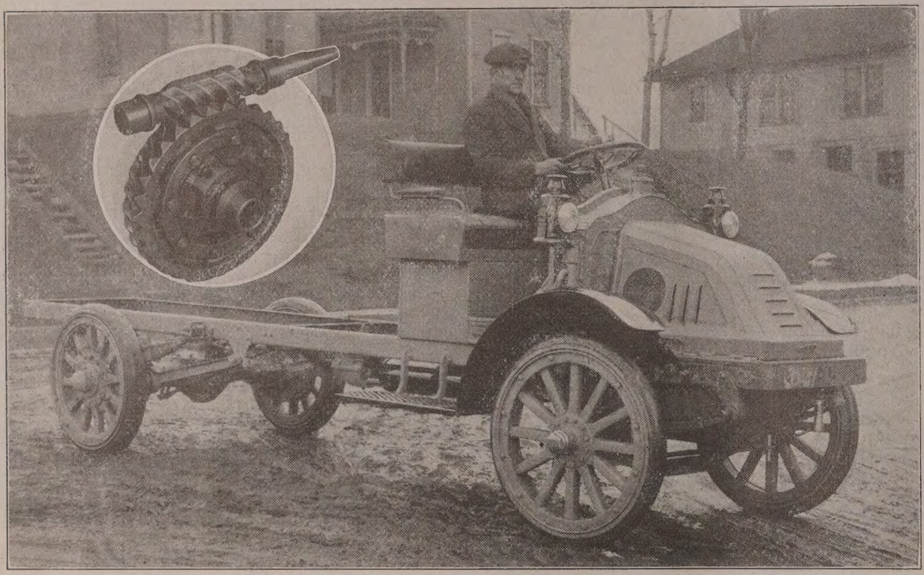
A new process for treating wood of all kinds is being put forth for commercial use by a company formed for the purpose, known as the American Wood Encysting Company, Inc. By simply immersing the green wood to be treated in an open tank containing the compound heated above the boiling point of water, the backers of the process assert that in a few hours at the most, depending on the thickness of the stick, the wood, besides being dried and waterproofed, is given a preservative treatment that is the equal of any process now in use. They claim that the method will protect crossties, structural timber and paving blocks, even under the most adverse conditions and that it will render piling immune against the teredo and other marine borers. They contend also that the treated wood is proof against termites and all other wood-destroying insects. Other important applications are of less interest to the civil engineer. The process was invented and patented by Col. R. A. Marr, of Norfolk, Va., formerly dean of the Virginia Polytechnic Institute, who has been experimenting on it for years. The first users of it were the Welin Marine Equipment Company, makers of life-saving appliances, and the Lundin Company, manufacturers of balsa wood products, both of New York City.

The process consists of encysting or coating the individual cell walls with a compound, of which paraffine acts as a base, whereby the wood is asserted to be made both impervious to moisture and insured against all known forms of decay. For certain purposes it has been found advantageous to increase the specific gravity of the treated wood to such an extent as to make it heavier than water, and this is accomplished in the above process by slight modifications in the regular treatment, which ordinarily tends to lighten the wood.

In a demonstration before a representative of this journal with small blocks of oak, longleaf pine, Oregon fir and balsa, action began almost on the instant of immersion, the bubbling on all sides apparently indicating penetration in every direction. Coloring matter had been added to the compound, and when the blocks were split up after immersion from half an hour to an hour and a half it was evident that the mixture had gone all through them. Although some of the blocks had been soaked over night in water, they appeared to be perfectly dry a minute after they were taken from the tank. One of the claims made by the company is that absolutely no preliminary seasoning is necessary, that green timber with the bark on can be treated and that such treatment accomplishes in a few hours a seasoning effect that requires from six months to several years to obtain by other seasoning methods, and at the same time prevents checking or warping.

Among many other advantages claimed for the process are that it can be applied to kinds of wood that will not take the ordinary preservatives—such kinds as white oak, osage orange, black walnut, shagbark and hickory; that it preserves the natural resiliency of woods, increases their modulus of elasticity and renders useful the cheaper varieties of wood that now check or warp too badly to be of structural value; that as "encysted" wood is perfectly clean and emits no odor except a faintly pleasant one, it can be used for floors where wood treated in other ways is out of the question; that it insulates thoroughly against electricity; that the first cost of installation as to treatment need be only a small fraction of that of the pressure types of plants now in use, and that the cost of the treatment itself is less.

Although the company has not as yet made any commercial application of its process to crossties, and admits that it has not been in a position to do so, the manager of the company suggested to this journal's representative that the elaborate stationary plant required for the treatment of 1,000,000 ties per year could, it was believed, be replaced by a portable tank arrangement at a comparatively small cost which would be operated by a locomotive, and moved about over the line to receive the ties wherever they were delivered on the right-of-way, and treated at once.



NEW MODEL OF MOTOR TRUCK EQUIPPED WITH GEAR DRIVE

The process has not, of course, been subjected to the acid test of hard and protracted service. The Richmond Cedar Works, of Richmond, Va., which operates many miles of private road, largely trestle, in the Dismal Swamp, and has found that these trestles, built of black gum, hardly lasted two years, has been using encysted black gum throughout in them for the last two years, and it is stated that none of the treated timbers have as yet shown any signs of decay. One of the accompanying photographs shows one of these trestles; the other shows the simple tank in which the wood was treated. The encysting company also exhibits treated paving blocks in service in Norfolk for three years and in excellent condition, and others untreated in service under the same conditions two years, and almost eaten away by the termite.

The American Wood Encysting Company, Inc., has opened an office in the Forty-second Street Building, New York City. Colonel Marr is president of the company. William F. Morgan, secretary and treasurer, is also a director of both the Welin Marine Equipment Company and the Lundin Company. E. H. Raquet, who as engineer of tests of the New York, New Haven & Hartford Railroad conducted an investigation into the application of the process to crossties of various kinds of wood, has recently resigned to become manager of the encysting company.

Map of the West Shows Activities of Interior Department

A map of the western portion of the United States, showing the location of the activities of the various divisions of the Department of the Interior, has recently been published by that department. The particular activities which are indicated include national parks and monuments, Reclamation Service projects and branch offices, as well as those of the Geological Survey, Bureau of Mines, Surveyors General, Chiefs of Field Divisions of the General Land Office and local lands, rescue cars and stations of the Bureau of Mines and Indian reservations and schools. The map is 26 x 18 in. in size and is printed in four colors. Copies may be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15 cents apiece.

Swivel Jointed Radius Rods Take Driving Strains in New Truck

In two new worm-driven motor truck models recently put on the market by the Kelly-Springfield Motor Truck Company of Springfield, Ohio, it is claimed that the frame is relieved of sudden shocks due to starting or quick application of the brakes.

The driving strains are taken up through the radius rods, swivel-jointed at each end, while the torque and braking action is taken through the springs.

Business Notes

The L. L. Wright Roofing, Waterproofing & Construction Company, of Brooklyn, N. Y., has moved its offices and plant from 543-545 Smith Street to 248-250 Lorraine Street.

Thomas J. Nolan, agent for surety bonds and liability insurance, of 75 State Street, Boston, has admitted his brother W. Henry Nolan into partnership and the firm name has been changed to Thomas J. Nolan & Company.

The Osgood Company, manufacturer of steam shovels, dredges, ballast unloaders and other equipment, of Marion Ohio, has purchased the manufacturing plant of the Ohio Tractor Company, thereby, it is said, doubling its capacity. The larger machine tools, for which crane service is desirable, will be moved to the main plant of the Osgood Company, while the smaller tools and the foundry will be operated at their present location. The Ohio Tractor Company has acquired a new site in the south part of Marion, and is making arrangements to increase its output.

The Consolidated Engineering Company of 507 W. Jackson Boulevard, Chicago, has purchased the land, buildings, tools, machinery and equipment of the Massachusetts Fan Company and has commenced the manufacture, at Watertown, of the blower, fan and heater apparatus formerly made by that company. John E. Anderson, for the past 24 years a ventilating engineer, and, for the last 7 years, with the B. F. Sturtevant Company in its Chicago office, in charge of the ventilating and cooling department, has been appointed sales manager in charge of the Massachusetts Blower Department and Kinealy Air Washer.

E. C. Porter, who, for two years, has been commercial agent in charge of the New York City office of the U. S. Bureau of Foreign and Domestic Commerce, has resigned from that office to become executive secretary of the recently formed American-Russian Chamber of Commerce, of 60 Broadway, New York City. Mr. Porter has had direct charge of the organization and the arrangements entered into between the Department of Commerce and the Imperial Russian Government for the purpose of assisting American business interests in importing goods from Russia. As a result of these arrangements, approximately $700,000 worth of Russian materials have been brought into the United States.

Col. John C. Hooven, organizer and president of the Hooven-Owens-Rentschler Company, manufacturer of Corliss engines, of Hamilton, Ohio, died in that city, March 1. Colonel Hooven was born in 1843, and took up his residence at Hamilton in 1874. In 1880 he organized the Hooven-Owens-Rentschler Company, and started in his career as a manufacturer of Corliss engines. In 1890 additions were made to the original plant that doubled its capacity. Some of the largest engines built in the United States were constructed under Colonel Hooven's direction, and, in recent years, the company turned out equipment for large sugar mills. In addition to his interest in the engine company, Colonel Hooven organized the Ohio Electric Railway Company, the Cincinnati, Lawrenceburg & Aurora Traction Company, and the American Frog & Switch Company, and had interests in such companies as the Dayton Rubber Company and the Champion Coated Paper Company. He is survived by his wife and four sons: C. E. Hooven, treasurer and manager of the Hooven-Owens-Rentschler Company; Paul Hooven, Boston representative of the company; E. Hooven, the Chicago agent, and D. Hooven, purchasing agent of the plant.

Trade Publications

The following companies have recently issued trade literature:

Bitoslag Paving Company, 90 West Street, New York, leaflet, 10 pages. Bitoslag pavement with specifications.

Continental Public Works Company, 2 Rector Street, New York, booklet, 44 pages, contract work on asphaltic and concrete roads, showing equipment and process.

W. & L. E. Gurley, Troy, N. Y., bulletin, 8 pages, Gurley precise transits; type used on Hell Gate Bridge.

A. S. Cameron Steam Pump Works, 11 Broadway, New York, bulletin 154, 16 pages, single and double suction, centrifugal pumps and sump pumps.

L. L. Wright Roofing, Waterproofing & Construction Company, 248 Lorraine Street, Brooklyn, N. Y., catalog, 20 pages. Indestructible asphalt-cement flooring for factories, warehouses, bridges and viaducts, and piers.

Gemco Manufacturing Company, Milwaukee, Wis., catalog, 20 pages. Gemco adjustable shores for trenching, holding forms for concrete, and beams, and brace and column clamps for supporting forms.

U. S. Sanitary Septic Tank Company, Memphis, Tenn., circular folder, sewage treatment tank for individual buildings, especially those isolated in the country.